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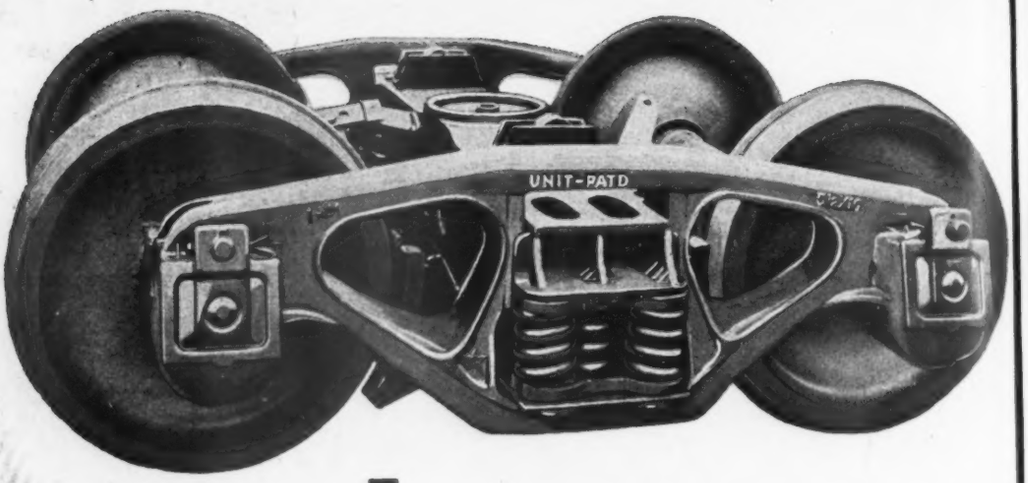

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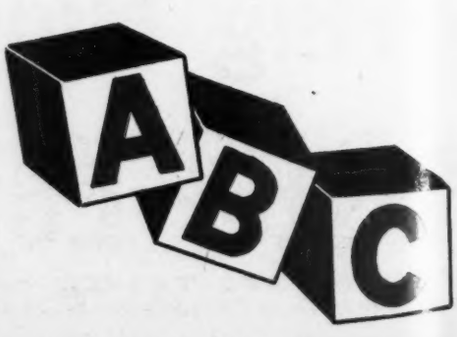

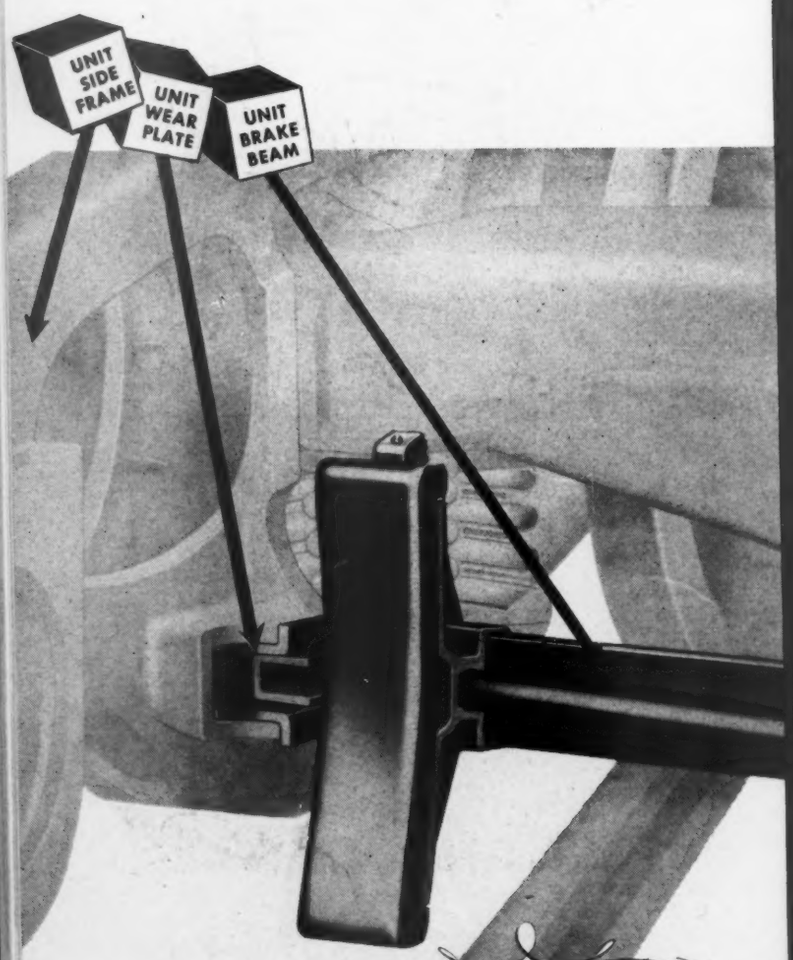

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Motive Power for Hump Service

*By A. H. Candee**

Hump yard operations require a locomotive especially adapted to the service—These requirements analyzed

RAILROAD operations involve the use of many types and sizes of locomotives for a wide variety of purposes. One of the important members of this motive power family, although seldom publicized, is the locomotive used for gravity classification yard work, normally called a humper. While it is frequently found that many railroad operations can be adjusted within reasonable limits to suit any particular size of locomotive, humping operations usually require a locomotive specifically adapted to that particular service, and for this reason, it is seldom that the most economical operation results by setting back road power into this class of work or by the use of conventional switchers.

Principles of Gravity Classification

While humping requirements vary widely for different railroads, depending upon the physical layout of the yard, character of the traffic, and size of trains entering the receiving yard, the basic operations usually differ little. A road locomotive hauls the train into a receiving yard and cuts off. The hump locomotive then gets behind the train or a portion of the train and moves it forward up a steep grade and over an elevated track, or hump, where cars are cut off while in motion and roll down off the hump onto the different tracks of a classification yard, depending upon destination. Opportunity is usually taken at the humping point to inspect cars and lubricate journals while moving at the relatively low speeds of humping operations, and to weigh them individually as they roll away from the apex of the hump toward the classification yard.

In order to weigh cars or to switch them to different classification yard tracks individually, it is necessary to separate them. This is done by dropping them down a steep grade as they are cut away from the train being humped, thus accelerating and automatically spacing them. Fig 1 indicates the approximate spacing between couplers for various humping and terminal speeds, but it may be pointed out that the number of cars per minute which pass over the scales or the first switch is related to the train speed at the apex of the hump and not to the speed after acceleration. Thus, if four cars per minute pass the apex of the hump, four cars per minute will pass over the scales whether these cars are accelerated to six, eight or ten miles per hour or any other speed, the only difference being the spacing between cars.

In general, the first slope downward from the apex is steep enough and long enough to accelerate a car to the maximum speed allowable for weighing, with this grade diminishing so that no further acceleration occurs until after the car passes over the scales. Immediately thereafter, however, the tracks take a severe drop (three to five per cent down grade) to build up the car speed, usually changing to a somewhat less severe grade to maintain speed through the switches until the cut reaches the yard tracks. The speed of the free cars, or cuts, rolling from the hump to the yard is reduced as necessary by riders and hand brakes or by car retarders at several points.

Humpers Require High Tractive Force

Since humps must be elevated in order to accelerate cars and roll them into the classification yard, it usually follows that the approach to the hump from the receiving yard is also on a severe adverse grade. Thus, a prime requisite of a humping locomotive is plenty of tractive force. In addition to that required for moving the train up the approach grade, surplus tractive force must be available for a reasonably fast acceleration with full tonnage on this grade after

* Transportation engineer, Westinghouse Electric Corporation.

an interruption of operations at the hump. Furthermore, it is frequently necessary for the humper to "set" a car down against a train in the classification yard because of the character of its lading, which means that the motive power must be able to brake the train down and pull it back up the roll-away grades before resuming humping operations. As may be expected, high tractive force generally necessitates a large number of driving wheels.

Horsepower Required

In general, a humper must be a low speed, high tractive force locomotive, which combination normally means relatively low power. However, since humping speeds are rather well defined at two or three miles per hour with a maximum of somewhere around four miles per hour, and approach speeds are usually at a maximum of six miles per hour, the maximum locomotive horsepower for steady upgrade moves is in direct proportion to the tractive force required. Thus:

$$\text{Approach hp.} = \frac{\text{6 m.p.h. x lb. T.F.}^{1}}{375}$$

$$\text{Humping hp.} = \frac{\text{4 m.p.h. x lb. T.F.}^{1}}{375}$$

[1] The tractive force required is readily determined from train weights, approach, grades and curvatures and usual rolling resistance values.

For accelerating the train from rest to the approach speed, however, the locomotive should be capable of exerting tractive force up to the slipping point of the wheels (say 25 per cent adhesion) from rest up to the maximum approach speed. The peak horsepower, then, is:

$$\text{Peak hp.} = \frac{\text{Lb. loco. wt. on drivers x } 0.25^{2} \text{ x 6 m.p.h.}}{375}$$

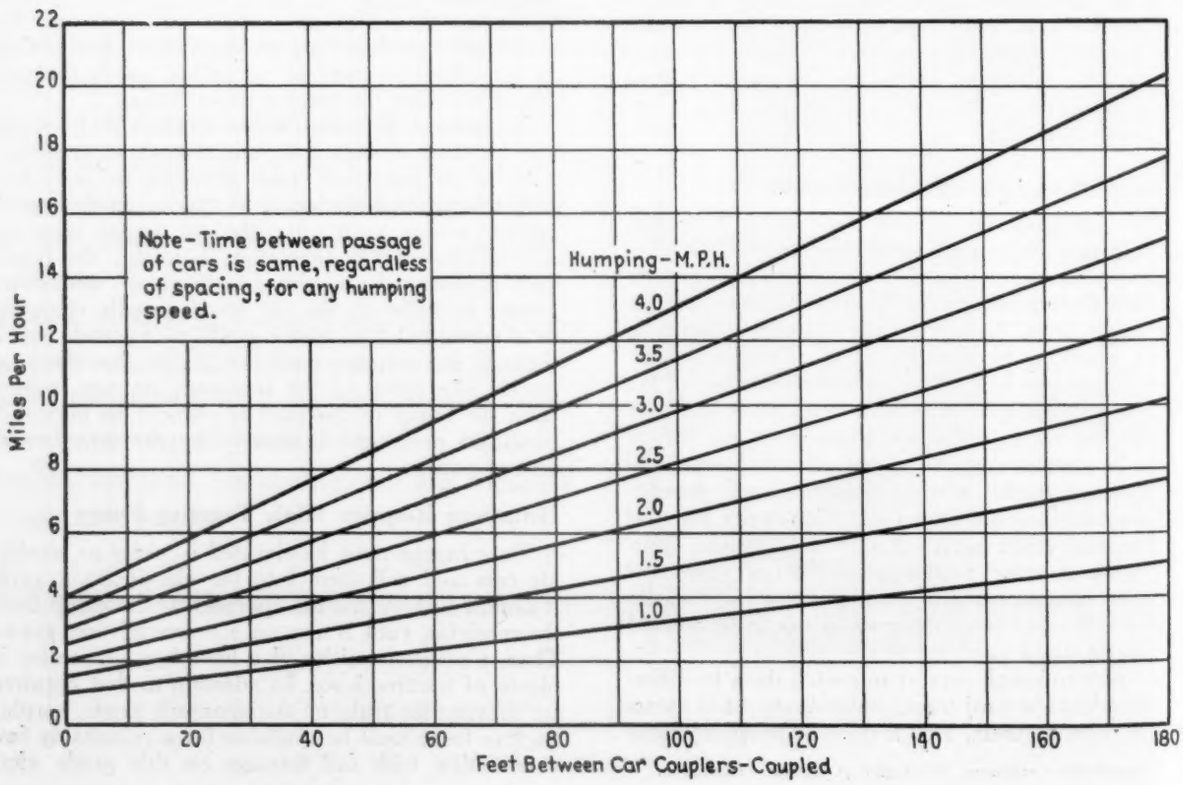
[2] Driver weight in lb. times the adhesive factor is maximum tractive force.

This is usually the figure which determines the locomotive horsepower capacity if delays to humping operations are to be minimized.

Close Control of Humping Speed Essential

A variation of one mile per hour in the speed of a road locomotive is of little consequence, but this same variation of one mile per hour when humping a train seriously affects the humping performance. With a normal humping speed of two miles per hour, a drop to one mile per hour doubles the time required for humping and an increase to three miles per hour may affect the weighing and classification work. It is essential, then, that humping locomotives be of such a character that close control of speed is obtainable when exerting high tractive force over the low speed range.

Fig. 1—The spacing between cars as they coast down the hump is dependent only upon the amount of acceleration given by the grade. This chart gives the spacing in feet between car couplers for various accelerations given by this grade. The number of cars per minute that pass a given point is governed by the rate at which these cars pass over the high point and not upon the grade



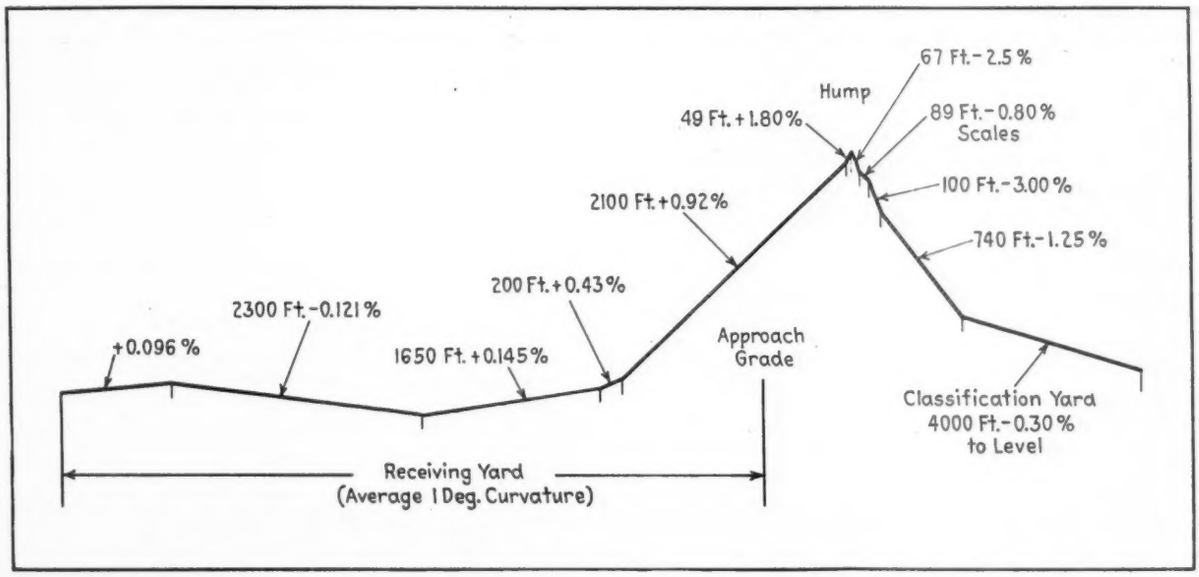


Fig. 2—This profile of a heavy humping operation is typical of the grades encountered

Typical Hump Operation

The principles involved in the selection of motive power for humping purposes can best be illustrated by their application to a typical heavy humping operation. For this purpose, an actual study recently made of a humping operation has been selected for illustration, the profile of which is shown by Fig. 2. Trains from the west are usually stopped in the receiving yard with the road locomotive near the receiving yard ladder track, which is about halfway up the 0.92 per cent approach grade. These trains vary between 8,000 and 12,500 tons in weight and are now being humped by two double-headed Mallet steam locomotives. In summer weather two 2-6-6-2 locomotives will handle a maximum train, but in winter weather it requires two 2-8-8-2 Mallets per train. In order to keep cars moving over the hump, four steam locomotives plus relief power are required to handle the service. These locomotives are old and must be replaced in the near future, so this study was made to determine the best type of power to replace them.

Humping operations are continuous, with the present steam locomotives being changed every 12 hours for cleaning fires and replenishing coal and sand supplies. Water is taken from plugs in the yard when needed.

TABLE I—PREFERABLE TRACTIVE FORCE REQUIREMENTS CALCULATIONS FOR MAXIMUM (12,500-TON) TRAIN AND TWO 250-TON LOCOMOTIVES:

Humping (Peak T. F.)		Resistance, lb.		
Tons	Grade, per cent	Grade	Curve	Train
100	+ 1.800	3,600	100	800
4,200	+ 0.920	77,280	4,200	33,600
400	+ 0.430	3,440	400	3,200
3,300	+ 0.145	9,570	3,300	26,400
4,600	− 0.121	11,130	4,600	36,800
400	+ 0.096	770	400	3,200
13,000		83,530	13,000	104,000

Train resistance (8 lb./ton) (Winter conditions) 104,000
Curve resistance (1 lb./ton) 13,000

Total resistance, lb. 200,530

TABLE II—BASIC SPECIFICATION FOR HUMPING MOTIVE POWER (MINIMUM REQUIREMENTS)

Locomotive weight on drivers, lb.	950,000 to 1,000,000
Number of driving axles	16 to 18
Humping horsepower at driver rims, 4 m.p.h.	2,100 to 2,200
or, prime mover horsepower electric-drive locomotives, 4 m.p.h.[4]	2,700 to 2,900
Accelerating horsepower at driver rims, 4 m.p.h.	2,500 to 2,600
or, prime mover horsepower electric-drive locomotives, 4 m.p.h.	3,000 to 3,100

[4] Calculations indicate that any form of electric locomotive should have an electrical continuous tractive force rating above 175,000 lb.

Note—Reduction of costs suggests the desirability of constructing the motive power with the above characteristics and for operation by a single crew, if possible.

Analysis of Motive Power Requirements

The characteristics of the motive power needed are dependent upon two operating requirements. The first of these is the tractive force and horsepower necessary to move the maximum train across the hump at humping speeds. The second is the tractive force and horsepower needed to start, accelerate, and move the train from the receiving yard to the hump with the minimum practical delay. The latter, of course, also involves the expeditious starting and acceleration of a train when resuming humping operations after an interruption.

To insure satisfactory operation under all conditions of rail, a locomotive should be applied at a working adhesion not greater than 20 to 20.5 per cent. To develop a tractive force of 200,530 lb., therefore, requires a weight on drivers of approximately 950,000 to 1,000,000 lb. At 60,000 lb. per axle, no fewer than 16 driving axles should be used, and with an axle load of 55,000 lb., 18 driving axles are required for satisfactory performance under cold weather conditions. This checks with the steam locomotive experience.

A maximum continuous speed of four miles per hour is desirable for expeditious humping. At that

speed, the horsepower which must be developed at the driver rims under winter conditions is:

$$\frac{200{,}530 \times 4}{375} = 2{,}130 \text{ hp.}$$

If trains are humped at three miles per hour, the horsepower required is 1,600, and at two miles per hour is 1,065. However, it is the maximum figure which determines locomotive size.

Much time may be lost during humping operations in accelerating and moving a train out of the receiving yard to the hump and when re-accelerating a train to humping speeds after humping movements have been interrupted. To expedite the humping of trains, then, it is desirable to have sufficient power available to maintain an adhesive value of approximately 25 per cent up to an approach speed of six miles per hour, if possible. From this, it may be determined that the maximum horsepower developed by the humping locomotive should be not less than:

$$\frac{950{,}000 \times 0.25 \times 6}{375} = 3{,}800 \text{ hp. at the driver rims}$$

TABLE III—ESTIMATE OF COMPARATIVE VALUES OF VARIOUS TYPES OF LOCOMOTIVES

	Steam locomotives		Electric locomotives				
	Recip. Mallet	Recip. Shay	Recip. steam	Steam turbine	Diesel plant	Trolley, power	Trolley, remote
First cost	A	B	C	D	C	E	F
Fuel cost	F	E	D	C	A	B	B
Crew expense	C	C	B	B	B	B	A
Repair expense	E	F	D	C	B	A	A
Fasting humping	D	C	B	B	B	B	A
Estimate merit	D	E	B	C	A	F	G

A = most favorable: G = least favorable.

As compared to the horsepower required for humping, this is high. Since a gain in humping time is not of particular consequence at this particular hump, assume that the maintenance of a 25 per cent adhesive factor up to the maximum humping speed will be satisfactory. Under this condition, the maximum horsepower required is:

$$\frac{950{,}000 \times 0.25 \times 4}{375} = 2{,}550 \text{ hp. at the driver rims}$$

Locomotive Types

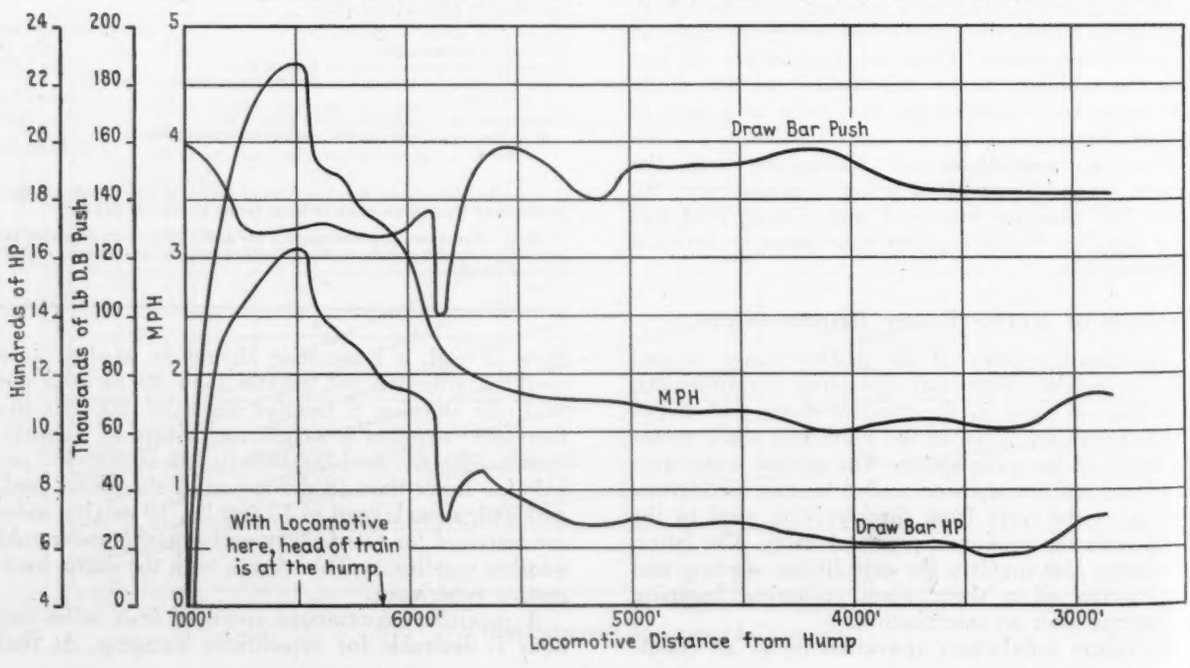
A number of different types of locomotives may be built to meet the foregoing basic specification. Among these are steam locomotives of the reciprocating, Mallet and Shay types; electric locomotives

TABLE IV—COMPARISON OF ANNUAL OPERATING EXPENSE OF FOUR LOCOMOTIVE TYPES IN HUMP SERVICE

	Steam[5]	Electric Locomotives		
	Mallet (recip.)	Diesel power	Recip. steam	Steam-turbine
Enginemen's wages	$114,000	$ 57,000	$ 57,000	$ 57,000
Fuel	160,600	63,000	127,500	106,000
Water	3,600	.....	2,900	2,400
Lubricants	2,500	6,300	3,000	3,000
Other supplies	1,000	300	700	700
Enginehouse expenses	51,000	51,000	51,000	51,000
Repairs	162,500	45,000	102,000	94,000
Total	$495,200	$222,600	$344,100	$314,100
Annual depreciation	0	53,600	66,000	78,000
Total annual expense	$495,200	$276,200	$410,100	$392,100
Annual saving over steam Mallet operation	.....	$219,000	$ 85,100	$103,100
Number of locomotives[6]	5	2-1/3	3	3
Total investment[7]	None	$1,307,000	$1,665,000	$1,965,000
Per cent return on investment (after depreciation)	.....	16.75	5.11	5.25

[5] Present steam power, fully depreciated.
[6] Including relief power.
[7] Includes additional facilities, parts stock, etc.

Fig. 3—Dynamometer car tests taken while humping a 12,500-ton train over the hump shown in Fig. 2



of the reciprocating steam-electric; steam turbine-electric; Diesel-electric, and trolley-electric types.

Of these, the reciprocating steam locomotives, without the electrical form of propulsion, must be built in two units and operated by two crews. (This is because of the difficulty of constructing a single locomotive with a mechanical drive of 16 or 18 axles. On the other hand, steam-electric locomotives may be built with a single boiler and any number of motor driven axles (either under the boiler or on an adjacent chassis) and may be placed under the control of a single engine crew. Likewise, a single crew may operate multiple units of Diesel-electric or trolley-electric locomotives.

Various Types of Locomotives

Steam locomotive—Mallet type: This design, even for but eight driven axles, results in a long locomotive with relatively high repair costs. Since two such units are needed for humping, two engine crews are needed and crew costs are high.

Steam locomotive—Shay type: This design of locomotive is also impractical for more than eight driven axles under one unit, so two units are necessary for humping a single train. As compared to the Mallet locomotive, this reciprocating type locomotive merely exchanges a reduction in boiler size and improved boiler utilization for a much more complicated mechanical drive with high repair costs.

Electric locomotive—reciprocating steam type: Although this type of locomotive has never been built, there are no new principles nor experimental problems involved. It consists primarily of a Shay locomotive design with a single boiler to develop the required horsepower, and multi-cylinder recriprocating engines driving generators for electric traction. This design retains the advantageous features of the Shay type locomotive and adds those of electric propulsion, while eliminating the expensive mechanical drive mechanisms of the Shay locomotive. With 16 or 18 traction motors, some may be under the boiler and tender and others on a coupled chassis. A single crew operates the locomotive.

Electric locomotive-power from a trolley system: The steam turbine-electric locomotive is not new, but its application to humping service involves a new boiler design and a new size of power plant, resulting in an expensive locomotive in the limited quantities required for humping applications.

Electric locomotive-Diesel engine power plant: Diesel-electric locomotives of sizes suitable for this hump are in commercial production. Such motive power has the advantage of relatively low first cost, low fuel and repair expense, and considerable flexibility in application to various other duties, if desired.

Electric locomotive-power from a trolley system: In itself, the trolley-electric locomotive is the simplest locomotive of all types. The usual difficulties in the application of this type of locomotive are the necessity of erecting a suitable power distribution system, construction of a power conversion substation, and the limitation of the usefulness of the locomotives to the electrified tracks. The important advantages of an electrification are reduced repair expense and improved availability.

Electric locomotive-remote control: In the interest of reduced delays and reduction of operating costs, consideration has been given to a system of remote control of electric humping locomotives. With an installation of this type, one operator at the hump will have immediate control of all humping moves and speeds, while a second towerman, located at the western end of the receiving yard, will have control of returning locomotives and coupling them to trains preparatory to humping. Such a system will reduce delays caused by fog, smoke, transmission of signals between the hump and locomotive crew, etc. The cost of such an installation, however, is high.

Economic Comparisons

Based upon the estimated merit of the various types of locomotives which may be used for humping, approximate operating expenses have been worked out for the first four types in the order of their estimated importance (estimated merit, A, B, C, and D). These expenses are tabulated in Table IV, which indicates that the economies are predominantly in favor of the use of Diesel-electric locomotives, and that these effect a net annual saving, after depreciation, of approximately $219,000. This corresponds to a return of 16.75 per cent on the estimated investment for this type of power.

In working out Table IV, costs have been prepared on the basis of continuous operation as at present, and it has also been assumed that locomotives in kind will be substituted when it becomes necessary to withdraw locomotives from service for inspection and repair purposes. As a matter of fact, a slight improvement in gross savings over those shown will result if Mallet steam locomotives are used for relief of the reciprocating steam electric or turbine steam electric locomotives. Consideration has not been given to the Shay steam locomotives or the trolley-electric locomotives as it is estimated that these are less economical than the four types analyzed in Table IV.

Savings Related to Operating Costs

It may be noted that comparative savings are all related to the costs of operating the present obsolete steam Mallet locomotives. As a matter of fact, when this cost analysis was first worked out, it was based upon the acquisition of new Mallet steam locomotives, with lower fuel and repair expenses than for the old locomotives, and with fixed charges for the new power included. Since in this case the difference in annual expenses between the new steam and the Diesel-electrics would be related to the *difference* in investment costs between the two types, this annual saving amounted to approximately 50 per cent of the additional investment expense over new steam power for the Diesel-electric type.

It has been shown that the Diesel-electric locomotive to handle hump service should have 3,000 Diesel engine horsepower and at least 16 motored axles. This can be built in several different ways, such as three 1,000 hp. six-motor units; two 1,500 hp. six-motor units with a four-motor trailer or one 3,000 hp. eight-motor unit with an eight-motor trailer.

The selection of type depends upon the individual preference of the railroad involved.

Mechanical and Electrical Considerations

In applying a locomotive for humping purposes, there are some mechanical considerations which must be given careful attention, particularly if the application involves self-propelled electric locomotives such as Diesel-electric power. Among these are track clearances.

The Interstate Commerce Commission allows a minimum clearance of 2½ in. above the top of the rail for any part of a locomotive other than the wheels. With worn wheels, the gear case clearance of a high tractive force locomotive using electric drive is down to the limit, yet car retarders are frequently found with burrs extending three inches or more above the rail head where interference will occur with the gear cases. This means that the locomotive wheels cannot be worn to their limit in this class of service or that the burrs will have to be removed from the retarders at frequent intervals. Another possible interference is the running gear of the locomotive when passing over the sharp vertical curve usually found at the apex of a hump.

The application of electric propulsion apparatus to a humping locomotive raises another problem which must be given consideration—the ventilation of the electrical equipment. The heat generated in electric generators and traction motors is carried away by ventilation, so it is essential that a full supply of this ventilating air be passed through the equipment at all times when full rated tractive force is being developed. However, in humping work, *full tractive force* may be needed but *full power* is not necessarily required during the steady slow speed humping moves. Since standard Diesel-electric locomotives reduce horsepower by reducing the Diesel engine speed, and because the fans supplying the ventilating air are frequently driven mechanically from the engine, a reduction in engine speed generally means reduced ventilation. Since full tractive force and electric heating is being developed, even though full horsepower is not, there is considerable danger of overheating and damage of the electrical equipment. It is customary to avoid this difficulty by arranging the engine to rotate at its full speed during all humping operations, adjusting the horsepower output to that required for humping by controlling the field of the Diesel engine driven generator from a separate controller in the cab. The use of standard Diesel-electric locomotives without some provision of this sort may lead to high repair expense or failures.

Diesel-Electrics Show Economy

Electric propulsion with its relatively high adhesive factors and nonpulsating tractive force characteristic is exceptionally well suited for hump service motive power. The results of many studies and actual applications show that the electric locomotive powered by a Diesel engine or engines invariably shows economies over other types of motive power in this service. It is not always safe to use a standard Diesel-electric switcher or road-switcher for this purpose, however, but when conservatively applied with a sufficient number of driven axles and when the proper attention has been paid to clearances, adequate equipment ventilation, and to the exclusion of sand dust from the apparatus, exceedingly satisfactory results are attained.

Fig. 4—Typical humping operation on the C. B. & Q. at Galesburg, Ill., using Baldwin-Westinghouse 1,000-hp. switcher with modified control

Illinois Central Puts All Electric Diner in Service

Fifty kilowatts of electric power is supplied by two General Electric-Buda undercar Diesel power plants

An all-electric dining car, recently completed at the Burnside (Chicago) shops of the Illinois Central, is believed to be the first of its kind to be placed in revenue service on an American railroad. The car is 85 ft. long, built of welded Cor-Ten steel and weighs 157,560 lb., a saving of over 10,000 lb. in weight as compared with former riveted carbon-steel cars.

The idea of an all-electric diner is not new to the Illinois Central, plans and designs for such a car having been worked out by the mechanical and dining service departments of the railroad, in cooperation with the General Electric Company, as long as three years ago. Priorities on metals and certain electrical equipment, together with an ambitious car-building program on the I. C., delayed completion of the car until last month.

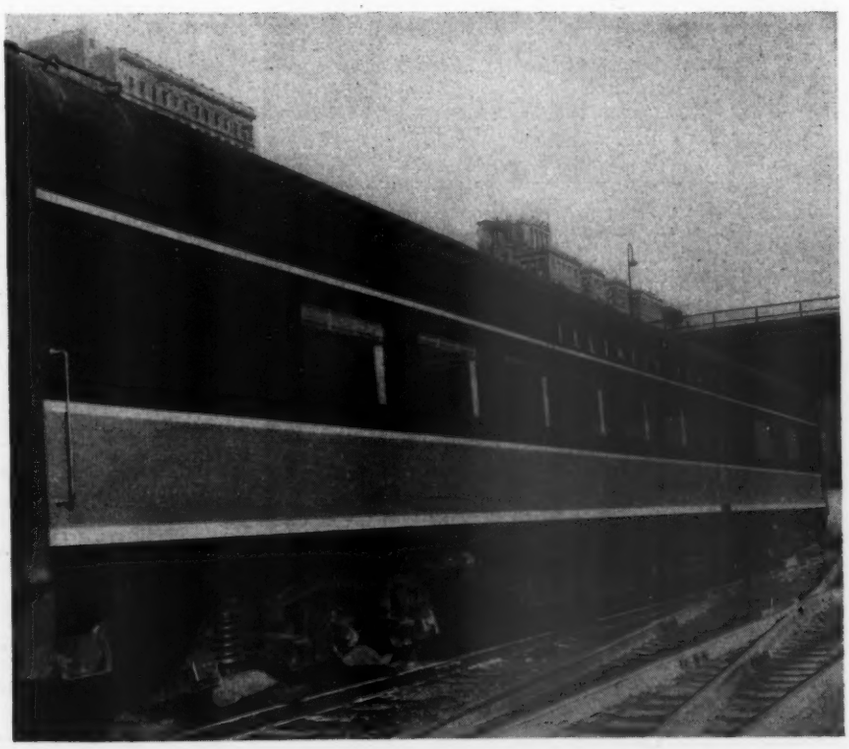
The new dining car includes an adaptation of the electric galley, developed by the U. S. Navy for cooking on submarines. Its use is expected to solve many troublesome problems experienced when cooking in confined areas and presents numerous advantages, notably freedom from excessive cooking heat, smoke and soot, with attendant increased cleanliness and improved working conditions for the car crew.

The substantial amount of electric power required, up to 50 kw., is supplied by two Diesel-driven generators housed beneath the car and drawing fuel from a 100-gal. tank which permits operation of the dual power plants for 24 hr. without refueling.

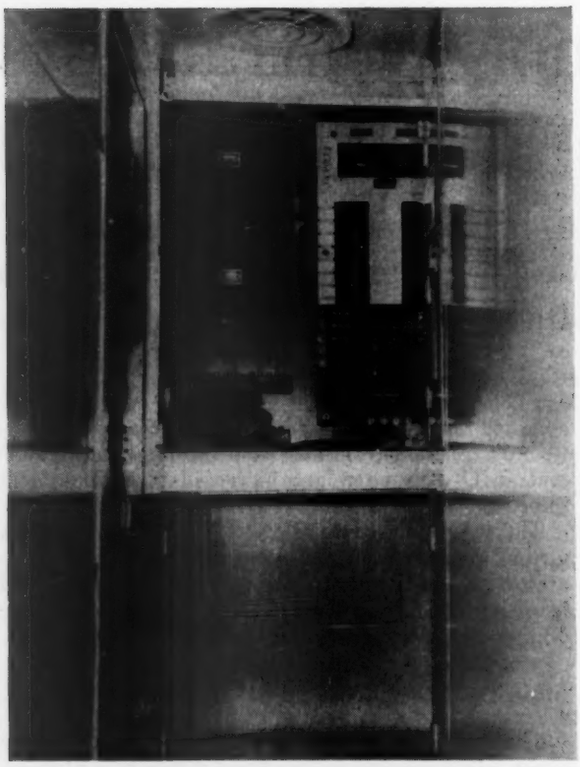
Stainless Steel Kitchen

The stainless kitchen of the new diner utilizes the latest advancements in electrical kitchen appliances and affords the completeness of a large hotel kitchen in a space 17 ft. long by 7 ft. wide, with 54 sq. ft. of standing area. The entire kitchen arrangement gives a definite impression of compactness and efficiency.

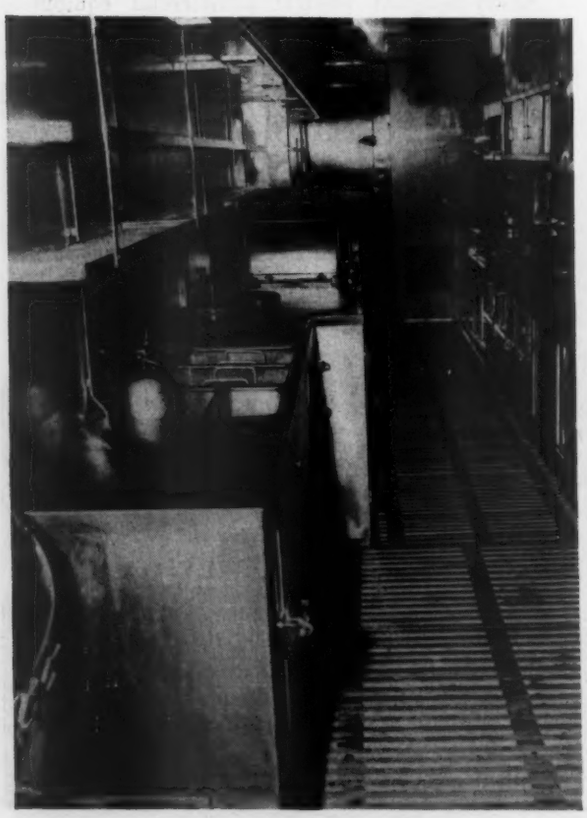
Newly-designed electric commercial equipment,



Exterior view of the Illinois Central all-electric dining car recently completed at the company shops at Burnside, Ill.



Above—Control panel consists of contactors, transformers and fuses, with relays and switches on a main panel arranged to divide the load. Below—General view of the several facilities in the all-electric kitchen



much of it previously unknown to railway food handling, has been built into compact galleys with the aim of bringing greater efficiency and convenience to dining-car operation. This equipment includes heavy-duty electric ranges, automatic electric broilers, bake ovens, deep-fry kettles, a garbage disposal unit, electric dishwasher, grills, griddles and coffee-makers, as well as an ice-making machine and other freezing equipment, including not only electric refrigerators but also near-freezing storage units.

The car employs especially-designed lighting and electric temperature control facilities. In the interest of efficiency, hot water used on the car is heated by the exhaust from the two Diesel engines under the car. This exhaust-heating system supplements heat available from the usual train steam-line. In addition, there is a 10-gal. electric hot-water heater to assist in boosting water temperatures. The kitchen and pantry sinks are equipped with an automatic steam-heating device thermostatically controlled to maintain water temperatures in accordance with U. S. Public Health Service regulations.

Under normal conditions, the new diner will be able to serve an average of nearly a meal a minute. The automatic electric deep-fry kettle, for example, occupies less than 2 sq. ft. and is capable of producing about 100 lb. of French-fried potatoes, fried chicken or fish hourly. The Hotpoint electric coffee urn has a capacity of 3 gal. and is similar in type to those used in restaurants.

Freezing Equipment

Eight different units of refrigeration equipment furnish varying degrees of coldness for food storage. The food-storage refrigerator has a capacity of 300 lb. and is used in the storage of meats. A counter and fish refrigerator is used in storing fish, sauces and gravies and has a capacity of 75 lb. Temperatures in these units are maintained at 35 deg. F. The frozen-foot refrigerator, used in storing out-of-season fruits and vegetables, maintains temperatures between zero and 5 deg. F., and has a capacity of 75 lb. The ice-cube storage refrigerator is operated at about 20 deg. F., and will hold 1,500 ice cubes. Salads, cocktails, milk, cream and butter are kept in the counter and cold-pan refrigerator, which has a

DIVISION OF ELECTRIC LOAD UNDER NORMAL OPERATION, WITH BOTH ENGINES RUNNING

ENGINE NO. 1 SUPPLIES:

- Motor-generator set (battery charging)
- Coffee urn
- Food-storage refrigerator
- Counter and fish refrigerator
- Frozen-food refrigerator
- Ice-cube storage
- Counter and cold-pan refrigerator
- Ice-cream refrigerator
- Ice-making refrigerator
- Fruit refrigerator
- Beverage refrigerator
- Range top and oven (right half)
- Hot food table
- Hall and vestibule lights
- Dining room lights
- Kitchen exhaust fans
- Work lights
- Refrigerator lights and fans
- 110-A.C. receptacle
  - Fruit juicer
  - Food mixer
- Picture and panel lights
- Glass washer
- Garbage-disposal unit
- *Charcoal-type broiler

ENGINE NO. 2 SUPPLIES:

- Range top and oven (left side)
- Deep-fry kettle
- Back-shelf broiler
- Plate warmer
- Cup warmer
- Bouillon-cup warmer
- Dish washer
- *Air-conditioning
- Hot-water heater

* These loads will automatically be discontinued if respective engine is overloaded.

temperature around 38 deg. F. A 17-cu. ft. fruit-storage refrigerator keeps oranges, lemons, grapefruit, fresh vegetables, etc., at a temperature of 38 deg. F. Beverages are stored in a special refrigerator and likewise are kept at a 38-deg. F. temperature. The ice-maker is capable of making 21 trays, or 588 ice cubes, every 96 min.

The range top has a cooking surface of 6½ sq. ft. Other cooking facilities include the steam table, charcoal-type broiler, back-shelf broiler, plate warmer, cup warmer, bouillon-cup warmer and bread-warming oven. Cabinet designs and assemblies were completed by the Illinois Range Company. Heating units were manufactured by the Hotpoint Manufacturing Company, a General Electric subsidiary.

An electric mixer, product of the Hobart Manufacturing Company, turns out fluffy mashed potatoes. This mixer also operates several attachments, including a power meat grinder.

A glass washer, designed by the Hamilton-Beach Company, is built into the cabinet sink assembly. The electric dishwasher, manufactured by the Hobart Company, is of the latest improved design. Dishes are automatically washed, soaped, rinsed and steamed in a single operation.

The garbage disposal unit was designed by the General Electric Company especially for heavy-duty railroad service. Refuse is ground, liquefied and passed off through a drain.

The new diner is equipped with modern Frigidaire air-conditioning equipment. In addition to the regular air-conditioning equipment, the kitchen has five Ilgair electric exhaust fans installed in the ceiling to draw cooking odors out of the kitchen.

Electric Power Supply

Electric power generating and conversion apparatus on the car consists of two model 6BD-230 Buda Diesel power plant assemblies for furnishing 220-volt, 3-phase, 60-cycle power; a motor-generator set with a 220-volt, 3-phase, 60-cycle motor and d. c. generator for battery charging; and all the necessary equipment for controlling and regulating the operation of all apparatus.

Each of the power plant assemblies consists of a housing arranged for under-car mounting and containing a Diesel engine directly connected to an alternator, complete with exciter and voltage regulating control. The set is mounted in the housing in such a manner that it can be pivoted to the outside beyond the edge of the car for servicing without making any disconnection other than that of the exhaust pipe. Provision is also made for removal of the engine-alternator set while in the swung-out position, and mechanical interlocking insures a secure position of the set in operating position before covers can be closed and fastened. When in normal operating position, the set is carried on vibration dampeners mounted inside the housing.

A propeller-type blade, or fan, mounted on the engine furnishes ventilating air for the alternator, and a separate radiator unit, complete with motor-driven fan, is provided for each power plant, the operation of the fan motor being thermostatically controlled by the temperature of the engine jacket water.

The heat exchanger, provided to heat water for kitchen use, utilizes exhaust gases from each engine. These gases pass through a flexible connection to a

Buda Diesel power plant in swing-out position for inspection and servicing

FUNCTIONS PERFORMED BY THE ELECTRIC CONTROL EQUIPMENT

1. Provide for starting and stopping the Diesel engines independently.
2. Provide for starting and stopping the motor-generator set for either normal or inverted operation and with automatic phasing in and synchronization with the engine-generator set selected.
3. Provide for disconnecting the air-conditioning and cooking load in case of failure of an engine-generator set, automatically maintaining the essential load or, if necessary, transferring it to the other remaining set.
4. Provide for inverting the motor-generator set operation to supply power for the essential load from the battery in case of failure of both engine-alternator sets. A reverse power relay prevents the motor-generator set from supplying power to any load other than the essential load under this condition.
5. Provide plug-in facilities for standby power with provision for preventing the paralleling of standby power with power from an engine-generator set.
6. Provide overload protection for the control circuits, alternators and motor-generator set with automatic reset in case of temporary overloads for each of the alternators and hand reset in case of a sustained heavy overload.
7. Provide for measuring battery voltage and the a. c. voltage of each of the alternators and of the motor-generator set.
8. Provide for the voltage regulation of the d. c. output of the motor-generator set. The main control panel is arranged for mounting inside the car, while the two cabinets are designed for under-car mounting.

POWER PLANT APPARATUS RATINGS

Buda Diesel engine type 6-BDG-230
39 hp. at 1,800 r.p.m.
A.C. generator with exciter and voltage regulator
25 KV.A., 1,800-r.p.m., 0.9 P.F., 220-volts, 3-phase, 60-cycles
A.C. induction motor with fan and radiator
3-hp., 3-phase, 60-cycles, 220-volts
Motor-generator set, type GMG-147-A1
220-volts, 3-phase, 60-cycles, motor
64-volts, 1,800-r.p.m., 10-kw. generator
Control panel, type 17FM70A1
Control groups, type 17KG105A1 and 17KG105B1

muffler and thence to a transfer valve which directs them either to the exchanger or to atmosphere, under control of a thermostat in the hot-water tank.

The motor-generator set is normally driven either from the 220-volt alternator of the engine-alternator set or from 220-volt a. c. wayside power and furnishes d. c. power for battery charging and for control, with the d. c. output regulated by a voltage-control relay. It may also be used for inverted operation, taking power from the battery and furnishing power for lighting, ventilating fan and coffee urn. While the set is operating inverted, the battery-charging regulator is disconnected, and special resistors with a negative temperature co-officient are connected into the d. c. motor-field circuit. Thus a fairly constant speed is assured and an essentially constant a. c. voltage output obtained.

Electric Control Apparatus

The total electrical load of the dining car has been divided into: (a) the essential load, consisting of lighting, battery-charging, refrigeration and coffee-urn requirements, and (b) the air-conditioning and cooking load, with the essential load normally supplied by alternator No. 1 and the remainder from alternator No. 2.

The control equipment, consisting of contactors, current transformers and fuses mounted in two control cabinets and of instruments, relays and switches mounted on a main control panel, is arranged to divide the total load into two classifications for normal operation and to perform other functions as listed in one of the tables.

If the No. 2 engine cannot be operated, all loads listed under engine No. 1 are available, the loads listed under engine No. 2 not being available. If No. 1 engine cannot be operated, the No. 2 engine will take all loads listed under engine No. 1 except the electrically-operated charcoal-type broiler and the loads listed under engine No. 2 will not be available.

Should it be impossible to operate either engine, the following loads are available from the battery (the length of time this operation can continue will depend on the charge in the battery and will probably be about three hours): Coffee urn, food-storage refrigerator, counter and fish refrigerator, frozen-food refrigerator, ice-cube storage refrigerator, counter and cold-pan refrigerator, ice-cream refrigerator, fruit refrigerator, hall and vestibule lights, one-half of dining room lights.

The following loads are operated directly from the battery at all times: Brake speed-control governor, electric locker and overhead unit lights, Vapor panel-fan and air-conditioning control, kitchen ceiling lights, a. c. power control, emergency lights—hall, vestibule and dining room (under automatic relay control from a. c. power).

Power obtained from standby lines handles loads in the same divided manner as shown for division of loads between the No. 1 and No. 2 engines.

Features of the Dining Room

The dining section of the new diner has a capacity of 36 seats. This section is paneled in ribbon mahogany veneer. Ceilings are painted a light gray. Between the windows are peach-colored panel mirrors. The window capping and table tops are Formica pearlescent plastic. Draperies are a dusty rose color. Plain red needlepoint material is used in seat covering. The floor is covered with blue-green carpeting in a magnolia pattern.

The diner is equipped with electro-pneumatic brakes to provide for quick and uniform application and release of air brakes. The speed governor controls the flow of air to the brake cylinder in proportion to the speed of the train, thus permitting smoother and shorter stops without discomfort to passengers or damage to equipment. It is possible with this equipment to exert a braking force equivalent to 2½ times the weight of the car.

High-speed 6-wheel trucks, equipped with Timken roller bearings, also contribute to the comfort and safety of passengers. All wheels on these trucks have cylindrical treads and are accurately balanced on a Bear dynamic balancing machine to assure maximum smoothness of operation.

LUBRICATION OF DIESEL LOCOMOTIVES*

By RAY McBRIAN†

The problem today of Diesel lubrication in the railroad field is one important part of the major problem which is to secure the lowest possible operating and maintenance expense with the highest availability and the longest possible life of all working parts with the maximum hours in service between major overhauls. Proper Diesel lubrication has a major duty to perform in this respect, but it must be remembered that it is only part of cooperative team work between the builder, the refiner and the railroad as a maintainer.

With the arrival of the first Diesel-type power on the D. & R. G. W. in 1941, we began observation as to what could be done in the way of controls, and, based upon these observations, decided that the control of Diesel-engine lubrication and resultant service performance could largely be regulated as a problem of chemical reactions in the engine crankcase. Experience has shown that if specific and regular analyses are made of used oil from each crankcase and of new unused oil before application, and if these analyses are properly interpreted, they can be utilized to prevent service failures, and to give the mechanical forces vital forehand information as to what is occurring in the engine. They also can be utilized to supply both the refiner and the engine builder with information of any seeming deficiencies which then can be studied for improvements.

A means is thus at hand to anticipate and prevent serious delays and failures; to prevent crankcase explosions and to have definite information as to wear rates, corrosion and other happenings to the engine while in service. In other words, the Diesel engine itself, tells what is being accomplished with lubrication. Since the engine does not recognize a lubricant by trade name, a designer's designation, nor a railroad mechanic who signs for a particular job, but does have its own individuality, it is able to furnish an accurate story of what happens in service.

Each Diesel unit should be made a test laboratory unit, since laboratory engine tests either by the builder, the refiner, or the railroad, can be used only to give basic information and for screening results. When Diesels enter the railroad field, we have the problem of cyclic changes in temperature and in operating conditions. Thus the constant load and test conditions of the laboratory do not duplicate actual service usage.

Since each Diesel unit has its own individuality, each road must determine by actual analysis under its service conditions what is happening in the engine. There are a number of other factors which influence the lubrication of the engine, such as fuel, operating temperatures, maintenance factors, materials of construction, and load factor. Even with these factors, crankcase chemistry analysis will permit detection of conditions arising from operation in time to permit necessary corrections to be made.

Results on the D. & R. G. W.

Before giving some of the detailed methods employed for actual test work, I would like to present, in general, some of the results secured on the D. & R. G. W. since 1942, when the first road power was placed in service:

Mileage—A total of 5,246,815 miles was covered by four-unit freight Diesels up to January 1, 1948, availability of 88.4 per cent, based on potential hours in service.

Crankcase explosions—None.

Oil drain—Draining of oil as required from tests, or for mechanical overhaul reasons; life of oil between drain periods, 150,000 to 300,000 miles.

Liners—Average age and mileage of liners in service since start of use of these locomotives, four years, three months; expected average mileage, based on present rate of wear and experience, 1,500,000 miles; average rate of wear, .001 in. per 500,000 miles; standard size liners in service, 85.31 per cent; oversize liners in service, 12.92 per cent; scrapped liners, 1,72 per cent. Oversize liners or rebored liners are all cases where scoring has occurred. No oversize liner is in service because of wear; no liners plated to secure increased life.

Piston rings—Less than 28 broken piston rings in five years of operation. We have never worn out a ring of the type which was supplied by the engine builder of these freight Diesels.

Crankshafts—Average age of crankshafts in service, four years, three months; total number 63; reground, 6,6 or 9.53 per cent. All undersize re-ground crankshafts have been necessitated by the use of bronze-back bearings.

Pistons—At present, there is only one unit of these four-unit Diesels in freight service with oversize liners and pistons. We have never scrapped any pis-

* Abstract of a paper presented before the Pacific Railway Club at a meeting held at San Francisco, Cal.

† Engineer of Standards and Research, Denver & Rio Grande Western.

ton for wear. We are scrapping about four per year because of cracks, detected by Magnaflux, in the ring bolt.

Main bearings—Our experience with freight Diesels is that we have run steel-backed main bearings for 750,000 miles without appreciable wear and can expect a mileage of 1,200,000. However with bronze-backed bearings with no appreciable wear we find they can be expected to fail in fatigue after 200,000 miles.

Additives—Analysis of additives in new and used oil to determine the required amounts to be maintained in service.

Impurities—Determination of residual impurities in new oils from improper refinery operations, thus preventing their use.

Reclamation—Reclaiming used oil, adding new concentrated additive and re-using in regular road locomotives.

Filters—Securing proper filter maintenance, and filter materials.

Reports—The reporting to mechanical department forces of specific need for replacement, repair of out-of-line conditions, etc., as indicated by these oil tests has resulted in cooperation between the departments and the realization of what can be accomplished when tests are properly evaluated, made regularly and when specified maintenance is regularly done and with fuels and lubricants kept clean.

Control Laboratory-Test Methods

In the actual testing of Diesel crankcase oils by the methods employed on the D. & R. G. W., it is necessary to have a control laboratory. Daily tests should be made at a laboratory in the Diesel operating territory of such tests as flash, fire viscosity, etc. Regular monthly complete analysis should be made at the control laboratory by whatever method the particular railroad deems best suited to its conditions. Our equipment was selected because, for us, it gives the necessary speed, accuracy and required data.

In preparation for tests, oil samples are taken direct from each Diesel unit crankcase. The sampler is a modified Lincoln suction oil gun, having a long copper pipe tube which will fit into the oil dip stick hole. Oil sample cans of ½-pint capacity are filled, grouped together and identified by individual locomotive and unit numbers.

Samples are taken immediately upon arrival at the terminal, and in some cases where Diesels are to be turned for passenger power, a chemist meets the Diesel on arrival and takes samples enroute to shops so that tests can be completed before the locomotive is dispatched.

Oil samples are delivered to the laboratory. In the regular tests made on each arrival or trip, the flash point is first determined. Switchers are checked each month and the following tests are run: Flash point in deg. F.; precipitation number; viscosity at 100 deg. F.; viscosity at 210 deg. F.; and ash, per cent.

Flash Test—The first test is the Cleveland open-cup flash test, made with four-unit equipment. This test shows any fuel dilution. Any flash test below 360 deg. F. for road Diesels indicates dilution from fuel and the crankcase is drained to prevent crankcase explosions and excessive wear due to low viscosity. Any flash test below the normal flash point of the specific type of oil used in a particular engine is noted and the engine checked by mechanical forces, upon advice by wire or phone from the laboratory, for fuel leaks. This can be fuel line breaks, loos econnections or injectors operating improperly. This test is observed also for water content; excessive water is indicated by sputtering and appearance of an emulsion in the oil or by appearance and form.

Precipitation—Precipitation number tests are run on any oil when its appearance indicates that there may be a possibility that free carbon or other dirt is present. The desired standard is to have the precipitation number below 0.05. When higher than that, various corrective measures are taken to get the precipitation number 0.05. For example, the mechanic may check the operation of the filter relief valve, or it may be found that the manufacturer's filter system will not function and the filter system is re-designed to cure the condition.

Viscosity—Viscosity tests are made on all new and reclaimed oils, as well as on the monthly locomotive test samples. The laboratory built two viscosimeter baths which handle all railroad Diesel unit tests as well as all Rio Grande Motorway tests. One viscosimeter bath is held at 210 deg. F., the other at 100 deg. F.

Ash—The ash content of the oil used in Diesel switchers where non-additive or additive oils are used is checked once every 30 days. However, if conditions require it on individual units, ash analysis may be made at more frequent intervals. Ash tests are made on receipt of all new oil shipments and each batch of reclaimed oils.

On Diesel freight and road locomotives, a set period for ash determinations is not less than 60 days, but individual units or a particular make of Diesel may, as a result of chemist's observation and experience dictated by service requirements, result in ash contents being determined at any time without specific regularity.

The best method is burning a 20-gram sample of the oil and igniting it. Each individual brand of additive oil will show a particular weight and appearance of ash. Non-additive oils should have no ash content.

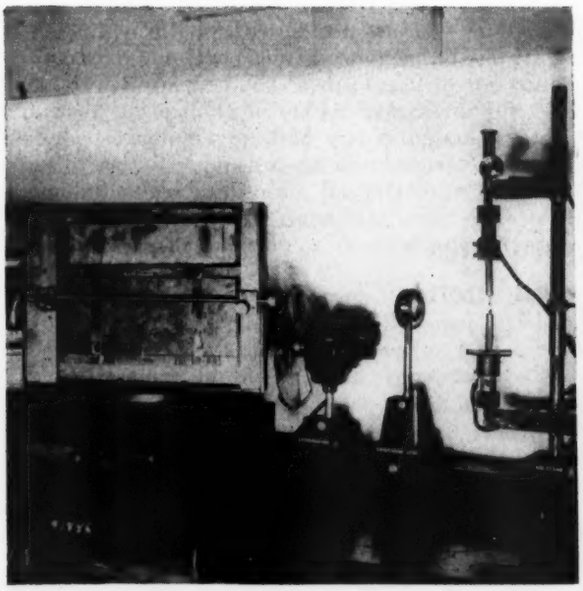
How Spectrograph Analysis Is Used

The spectrograph is an ideal tool to assist in routine engine maintenance as well as in experimental work. It is an optical instrument which can be used for qualitative and quantitative chemical analysis, effected by the examination of the photographed spectrum of the substance to be analyzed.

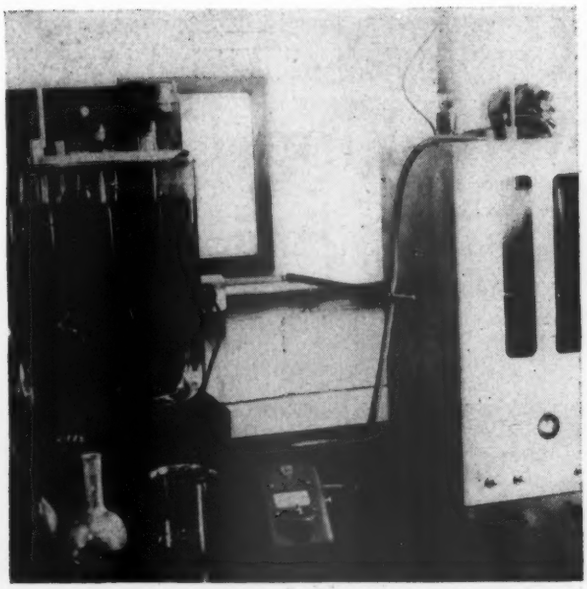
The spectrograph used by the Denver & Rio Grande Western is the Littrow type, quartz prism.

The samples for spectrographic analysis are taken from prepared ash samples and a measured amount of ash completely burned in a d. c. arc. The samples are measured in a specially-designed measuring tool, calibrated in milligrams.

With the help of spectrographic analysis, incipient engine failures can often be detected in early stages, thus preventing more costly road failures and further excessive damage to other parts of the engine as a result of such failures. This is done through the



Photographic equipment and direct current arc



Two viscosity test baths—100 deg. F. and 210 deg. F.

semi-quantitative analysis of the lubricating oil for both soluble and insoluble contaminants; metallic deposits found on the crankcase screen; deposits of muck on bearings, gears and other such parts; oil-line residues, and valve scales. If excessive amounts of certain elements are detected in the analysis, a hint is given as to the location of some improper operation and the mechanic can be advised what to check. Thus time is saved in detecting the difficulty and some abnormal operation or condition can be corrected in the early stages before further and more serious damage is done.

A knowledge of the materials of which the various engine parts are made, along with the metallic constituents of the lubricants, fuel, and water-treating chemicals in use, and of the general conditions under which the engine operates, is of course necessary before comprehensive conclusions can be drawn from the analytical results.

Analysis of the lubricating oils is one of the most helpful ways of indicating the mechanical results of engine operation. Although actual amounts of the elements present in the oil may be of assistance as a method of measuring wear rates of engine parts, or determining the deterioration of additive agents in a detergent oil, they are not of as much interest to us as is the ratio of the amount found when some abnormal condition exists. Over a period of time, spectrograms are taken of lubricating oil ashes from various engines, and as experience is built up the relative amounts of the elements found in the ashes of the various types of engines become known.

If the air filtration system is inadequate or poorly maintained, elements which are commonly found in road dust will appear in excessive amounts in the oil, i.e., silicon, aluminum, titanium and magnesium. Bearing corrosion may be detected by the appearance in the spectrogram of bearing metals in solution in the lubricating oil, i.e., copper, lead, tin, antimony, silver and cadmium. Excessive wear or abrasion are also indicated in this way by the appearance of iron and aluminum, and poor oil filtration may be detected similarly. If a detergent oil is used, appearance of the lines of the additive elements in the spectrum is a good check on the amount of detergent left in the used oil. Chromium is one of the elements commonly found in water-treating chemicals, so if chrome-plated rings or liners are not used, this may be the source of an excessive amount of chromium.

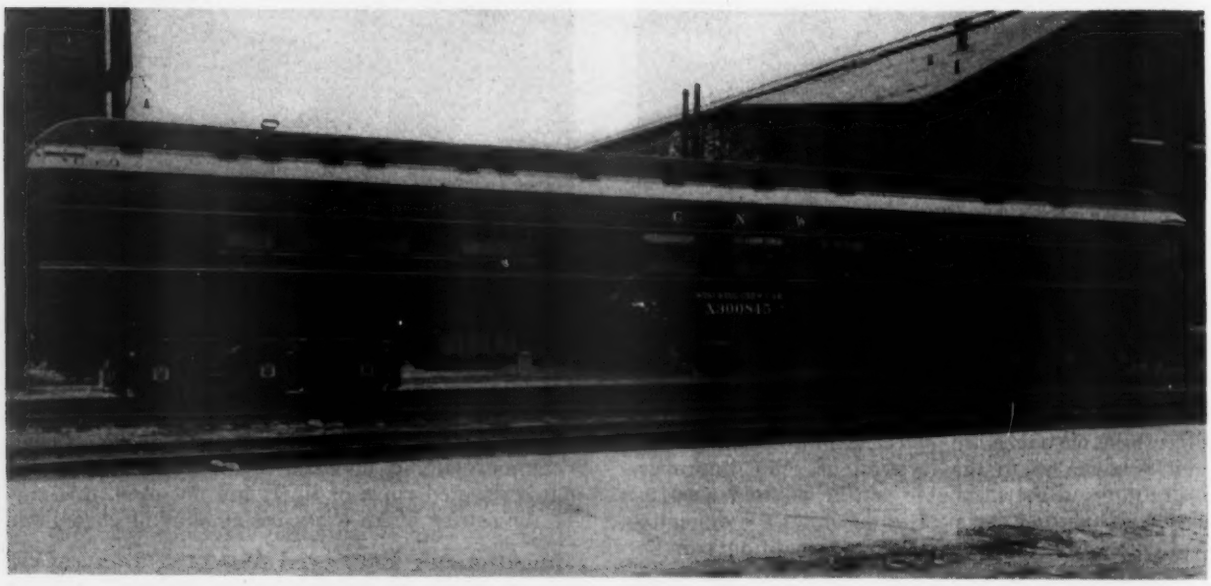
Densitometer Employed Also

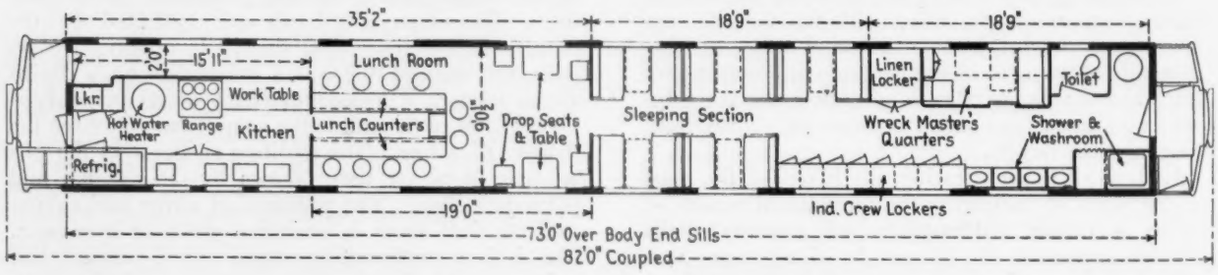
An enlargement of a portion of a spectrogram shows copper, silver, calcium, potassium and sodium lines. The amounts present are indicated by the density of the individual lines. If quantitative results are desired these are calculated on a Baird Densitometer. The densitometer projects an enlarged view of the plate and at the same time measures the density of a line. The additive elements in the oils we have used are those shown by the calcium and potassium lines. The presence of silver and copper indicate that there is excessive wear or corrosion. This is then confirmed by actual engine examination.

It may be found, under certain conditions, on analysis of the ash content of the used crankcase oil and confirmed by spectrographic analysis, that there is a serious loss of additive from the oil in a short period of time. This deficiency of additive is due entirely to low-temperature operation and can affect the properties of the oil to such an extent that corrosion, excessive wear, lack of detergency, can result in serious operating difficulties. The limit to which additive loss can be permitted must be determined by analysis of a particular engine oil and of the metal pick up and a study of the oil condition. Studies will also show range of temperature which must be maintained. As to report forms, each railroad should develop its own. The important point is the necessity of making regular checks and detailed analysis so that a history of each crankcase can be had.

C. & N. W. Wrecking Crew Car

Sleeping car, rebuilt in company shops, provides new standards of comfort for a total of ten men





Exterior view and floor plan of C. & N. W. wreck crew car

THE Chicago & North Western recently placed in service a special wrecking crew car which promises new standards of comfort for personnel engaged in picking up derailed equipment. These crews are often subjected to long hours under adverse climatic conditions, and the desirability of furnishing them with comfortable living accommodations while on the road has long been recognized.

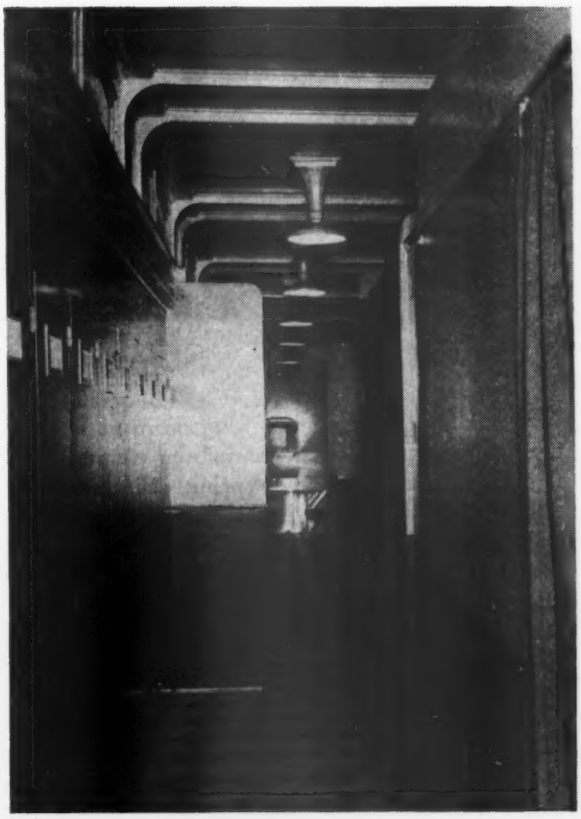
The new car, converted from an 82-ft. steel diner, is equipped and will be used as part of equipment accompanying a recently-purchased 250-ton Bucyrus wrecker, which is assigned to the Galena and Wisconsin divisions and the Chicago terminal and located at Proviso, Ill. It is planned ultimately to equip all wrecking outfits on the road with similar cars.

The crew car, as converted at the Chicago shops of the C. & N. W. in accordance with designs developed by G. R. Andersen, superintendent car department, utilizes the original kitchen without change except for the addition of a 40-gal. Crane hot water heater; a six-burner stove, both of which use propane gas for fuel, and two overhead water storage tanks of 250 gal. combined capacity. Two compartments, each carrying three propane gas tanks, are located under the car and supply fuel for the stove and the hot water heater.

Directly adjacent to the kitchen is a 19-ft. lunch room with horseshoe counter designed to seat 10 people at one time. Food is dispensed to the counter through an opening in the kitchen partition. Seats, of the swinging type, fold under the counter when not in use. The lunch room also has two drop tables and individual drop seats for other use as needed. The floor of the lunch room and other parts of the car, except the kitchen, is covered with Terraflex plastic tile.

Next to the lunch room, an 18-ft. 9-in. sleeping section with five Pullman sections—upper and lower berths—furnishes accommodations for 10 men. In addition, there is an 8-ft. 8-in. roomette-type compartment for the wreck master which can also be utilized as an office. This end of the car is equipped with toilet room, supply lockers, shower bath, four Allegheny steel wash basins and eight individual sealed lockers for the crew.

A Vapor No. 557 coal-fired hot water heater furnishes heat for the car. Electric current for lighting and operating fans is supplied by a gasoline-engine driven 1-kw. generator, located in a tool car which accompanies the crew car. The only other change made in the car structure was that of blocking up three windows on one side of the car and one window on the opposite side behind the locker and wash basin sections.



Right—Wreckmaster's office and lockers; Below—Lunch counter and Pullman sections

EDITORIALS

Unfortunate Stagnation

There has been a gradual slowing down of the rate at which freight-car orders have been coming in to the builders' plants since last spring. Since the first of the present year the decline has become sharp. During December, 1948, orders were received for 8,368 freight cars of all types by the shops of the builders and the railroads, and on January 1, 1949, the backlog of undelivered orders amounted to 103,896, according to the American Railway Car Institute. In January, 1949, orders dropped to 1,568 and on February 1 the backlog had dropped to 96,214—23,497 fewer than one year earlier. During February orders for new cars all but disappeared with a total of 332, and on March 1 the backlog of unfilled orders was down to 85,974, a drop from March 1, 1948, of 35,962 cars.

There are two principal causes for this slowing up of orders: the reduction of carloadings and the current high prices for cars. But whatever the cause, the effect is disappointing from many angles. Not the least of these is the retardation this will cause, if continued for many months, in improvement in the character of the freight-car inventory. The improvement is needed to meet the pattern of service which the railroads are beginning to develop in some places and which they are thinking about with growing seriousness everywhere. That pattern demands cars which are adapted to higher speeds than are most of the old cars in service, more than a third of which are 25 or more years old.

Old Cars Cause Failures

While the bad-order situation has not deteriorated appreciably during recent months, there are many cars which are unduly expensive to maintain and which are also none too reliable. It is from such cars that most of the failures in service come which require cars to be set out for repairs or for transfer of lading. Such failures are decidedly damaging to the quality of the service in two respects: they delay deliveries and lead to lading damage. Neither helps to keep the good will of shippers.

Some of the factors which are going into many new freight cars and which adapt them to meet the maximum demands of present-day freight-train service are high-speed trucks and draft gears with softer intial action. While not all new cars are going to include either or both of these features, the rate at which they will be introduced into the national freight-car supply will be slowed up by anything which reduces the rate at which new cars are built and installed on the railroads.

With competition for traffic growing more severe, anything which delays improvements in the service is a matter of serious concern.

Degreasers and Insulating Varnish

Diesel-electric shop operators who use vapor degreasers for cleaning traction motors know how they save man hours and eliminate onerous work. A vapor degreaser can do in thirty minutes a job which would take eight hours by the "scrape and squirt" method. And when an armature comes out of the degreaser, it is almost as dry—by the Megger—as it is when it comes out of the bake oven.

A question which lingers in the minds of the prospective users is, "What does the degreaser do to the varnish?" The agents used must, of course, attack oil if they are to be effective, and practically all types of insulating varnish contain oil. Fortunately, the oil in the varnish is not completely free to the action of the solvents, particularly if the varnish is set by polymerization.

Those who use the degreasers say that they do remove a surface film of varnish and that this is good since embedded bits of metal and brake shoe dust go with it. They add that this is good procedure since this film is replaced in the vacuum impregnator without undue clogging of the ventilating ducts by accumulations of varnish.

Some varnish manufacturers are apprehensive. They hold to the opinion that the solvents may cause the varnish to become porous or otherwise deteriorated in a manner which cannot be restored in the vacuum impregnator. To this the manufacturers of impregnators say: "Be sure you have a sufficiently high vacuum and that you leave your armatures in the varnish under pressure for a sufficient length of time."

Still others say, "We are now going to the use of silicone varnishes and they are more easily dissolved than other synthetics." That raises the question of whether this is correct or not, and if correct, can silicone be protected by means of a surface application of some other varnish, the silicone serving to protect hot spots deep in the coils, and the other varnish to protect the silicone?

Degreaser Must Have Shock-Load Capacity

One recommendation has been made which seems to fit the present situation. In substance, it is about as follows: The degreasing of an armature must be done discreetly in a degreaser which has a sufficient shock-load capacity. The heating element must be large enough to keep the vapor level above the armature all the time it is in the tank. If there is not enough heating capacity, the vapor level will fall when the armature is introduced and time must be allowed for it to build up again while the armature is held up out of the vapor. This sometimes requires dipping the armature into the vapor several times. When the vapor stays up, the total time is relatively short and the operation permits of accuracy of control. It would seem that a short, accurately timed dip would be much more apt to have the desired surface effect and would avoid a tendency for the solvent to work into the varnish.

Of course this is theorizing, and it will be highly beneficial to the makers of degreasers, varnishes, vacuum impregnators and the railroads if representatives of these groups get together, and make a study of the subject. The fact remains that degreasers are being used successfully for cleaning, but some applications have still to be worked out, and it is most desirable that each operator understand how to use his degreaser to best advantage. There is much to be gained by a study that will determine best procedure.

Two Ways of Inviting Trouble

Because the facilities devoted to the servicing and repairing of Diesel-electric motive power are normally vastly superior to the facilities which perform similar functions on steam locomotives, it is all too often assumed that there is nothing left to be desired in providing the physical plant necessary to handle Diesel power. This is far from always the case. Instead of installing a separate and properly designed structure for Diesel maintenance, there is already a trend toward converting present steam facilities, or parts thereof, to Diesel-electric facilities that may cost dollars for every penny saved. Too often the existing structure does not lend itself in more than a bare minimum way to the use to which it will be put.

No example of the short sightedness of this policy is more obvious than the employment of increasingly larger numbers of stalls from steam roundhouses for Diesel locomotive maintenance. The fire risk alone should be sound reason for pausing and considering the disadvantage of using more than two or three such stalls at most for maintaining Diesel power. Should fire break out in the Diesel portion of a roundhouse in which there are more than two or three Diesel units, the time consumed in getting any appreciable number of locomotives out over a single turntable could easily be great enough to spell physical disaster to the locomotive and financial hardship to the railroad.

In most cases the original conversion of a portion of a steam roundhouse to a Diesel maintenance section involved but one, two or three stalls and was used when and where the number of Diesel locomotives was small. Where the conversion could be made in such a manner that the work on Diesel power could be performed efficiently, such conversions were sound policy. There is not a great deal of risk from fire where only one or two units need be removed. It is in the continued and creeping expansion of such Diesel maintenance sections to four and five and more stalls that the danger lies.

Roundhouses are obsolete enough for most steam locomotive servicing work because of the inevitable turntable delays and the need for continued movement of men and tools from one stall to another. For Diesel power, these disadvantages apply more forcefully, (1) because of the far greater cost of this type of locomotive with the consequent need for minimizing repair and service time (2) because of the awkwardness of splitting up units, and (3), above all because of the vulnerability of Diesel locomotives to costly fire damage.

What Statistical Reports Show

The condensed statistical reports of mechanical department operations on railroads, individually and as a whole, are studied with the keenest interest because they reflect satisfactory results in certain phases of the work and other points where improvements need to be made. In all analyses of these reports, it is of course essential to know how the various figures are compiled, what the units mean and something about comparative operating conditions in order to arrive at intelligent decisions.

The first performance figures generally looked at are maintenance of equipment expense, the relation

it bears to total operating cost and how this ratio varies from month to month and with that on neighbor roads. The expenditures involved differ widely, dependent upon the size of the road and may be a few thousand or a number of million dollars a month. Moreover, the ratio of equipment maintenance to operating expense is highly variable even on the same road at different periods and it is these differences which require analysis in the interest of securing most efficient operation.

For example, railroads generally spend about 5 per cent more money maintaining equipment than track and fixed structures, but in a few instances these figures are reversed and, when this occurs, it is logical to ask why and make sure that the reason is not deferred repairs or an undesirably low standard of maintenance of cars and locomotives.

Then there is the wide variation in ratio of equipment maintenance to total operating cost on different railroads to account for. Examination of figures for a selected group of carriers for the first 10 months of 1948 shows ratios from 19.1 per cent to 25.4 per cent and one of 33.7 per cent. Unquestionably, physical factors, difficult to change, are responsible for some of these differences but the relative efficiencies of labor forces and particularly the amount of modern labor-saving equipment and facilities also have a bearing and hence need to be checked.

In the locomotive department, the number of locomotive miles in proportion to ownership is important, also the cost of repairs per locomotive mile, miles per locomotive failure, enginehouse expense per locomotive mile and per locomotive handled, cost of fuel, water lubrication and other locomotive supplies per mile. These figures require prompt and constant checking in the interest of more effective locomotive maintenance and use.

Some of the factors which receive closest consideration in the car department include the number of employees and payroll, unit cost of freight and passenger car repairs, freight car repair billing, train delays due to car failures and hot boxes, per cent bad-order to revenue cars on line, air brakes cleaned, journal boxes repacked, draft gears inspected, journal packing and car oil reclaimed and purchased new.

In the car department, as well as the locomotive department, the statisticians and accountants have a field day. There is altogether too much tendency to continue certain records which perhaps have long outlived their usefulness. Long delay in making current performance figures available greatly reduces their usefulness. Practically all of the figures mentioned are susceptible of misinterpretation and, in some instances, they may be compiled more for a paper record than to give a real measure of operating results. With all their limitations, however, mechanical departments cannot be run satisfactorily without operating statistics. The more simple, accurate, easily understood, promptly available and widely used they are, the better.

NEW BOOKS

DESIGN FOR WELDING. *Published by the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. 1024 pages; 6 in. by 9 in.; cloth bound. Price, (in U.S.A.) $2; elsewhere, $2.50.*

The book, a compilation of papers submitted in the Lincoln Award Program, makes available in separate sections a record of representative welded designs in several fields. The papers are reports of proposed designs, reinforced and substantiated by accounts of similar work already constructed. Each tells how a given organization has solved its own problems. Section III on railroad applications has chapters on Redesign of Diesel-Electric Locomotive Underframes; Improvements in Welding of Diesel-Electric Locomotives, Arc-Welded Parts for Diesel Locomotive Engines, Producing Improved Box Cars at Reduced Cost by Arc Welding, Low-Alloy Welded Box Cars, Cost Reduction for Railroad Passenger Cars, and The Application of Arc Welding to Locomotives.

GAS TABLES. *By Joseph H. Keenan and Joseph Kaye, professor and assistant professor, respectively, of mechanical engineering, Massachusetts Institute of Technology. Published by John Wiley & Sons, New York. 238 pages; 7½ in. by 10½ in.; cloth bound. Price, $5.*

In this book, which supersedes a previous one entitled "Thermodynamic Properties of Air," the properties of air have been re-examined and recalculated, the properties of combustion of hydrocarbons and of the constituent gases have been added, and tables of functions useful in analysis of the flow of compressible fluids have been extended. All values of the thermodynamic properties are based on the examination of data from spectroscopic sources published by F. D. Rossini and his co-workers of the National Bureau of Standards in 1945.

ELECTRIC AND DIESEL-ELECTRIC LOCOMOTIVES. *By D. W. Hinde, B.Sc., A.M.I.E.E., A.M.I.Loco.E., and M. Hinde. Published by Macmillan & Co., 60 Fifth avenue, New York. 366 pages; 5½ in. by 8½ in. Price, $9.25.*

The outstanding characteristics of electric and Diesel-electric locomotives, both foreign and American, are described in this book. The ten chapters deal with motors; control gear; auxiliaries; d.c., a.c., and convertor locomotives; Diesel engines and transmission systems, and Diesel-electric locomotives. The trends of future design are also discussed. The tables in the appendix contain information gathered throughout the world on direct-current locomotives (from 1925); single phase, alternating-current locomotives (from 1925); convertor type locomotives (from 1925); "three-power" locomotives, and Diesel-electric locomotives (from 1930).

SHOPS AND TERMINALS

West Albany Flanging Operations

A wide variety of both hot and cold forming operations on parts for steam locomotives, tenders and electric locomotive boilers are performed at the West Albany, N. Y., shops of the New York Central. The work is done on a 400-ton Lake Erie flanging press, with the aid of a McCabe pneumatic flanging machine for certain flanging operations.

Typical of the forming work done is the flanging and shaping of the rear tube sheets. The flanging along the top and the upper portions of the sides is done cold in two steps on the pneumatic flanging machine. One-half the bend is put in in the first step and the remainder in the second step, both in lengths of five to six inches at each pressing. The sheet is then transferred to the heavy hydraulic press to put in the two horizontal bends near the bottom, which is also done cold. The bottom-most bend is put in first, followed by the upper bend.

The remainder of the side flange, that extending below the top horizontal bend on either side, is put in by hand while the sheet is held by a holding die shaped to fit the sheet. For flanging these bottom sections, one side of the tube sheet at a time is heated on a coal forge. After all flanging has been completed the sheet is put in a furnace for annealing and later straightening.

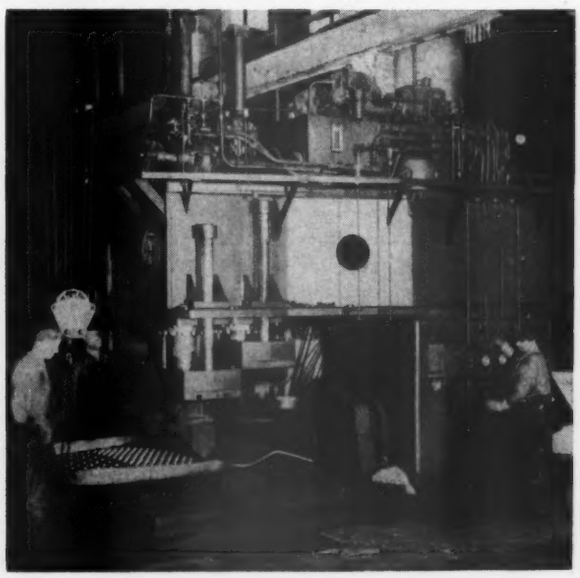
Firebox door sheets having a large radius at the bottom mud ring corner are flanged cold around the top and along the sides to within 36 in. of the bottom on the pneumatic flanging machine. The bottom 36 inches of the flanges are done on the hydraulic press after heating. Firebox door holes in the back head or door sheets, are formed in dies after the door-hole opening has been burned out. All door holes are completed in one operation except the O'Connor-type offset hole which requires two operations.

Waist-sheet angle irons are heated and formed to radius in a die in the hydraulic press. After going through the die the angle irons are placed in a furnace and heated, then sized on a forming block to the final boiler diameter desired. Only one size of die is used for all boiler diameters as the majority of boilers going through West Albany Shops have diameters within four inches of each other.

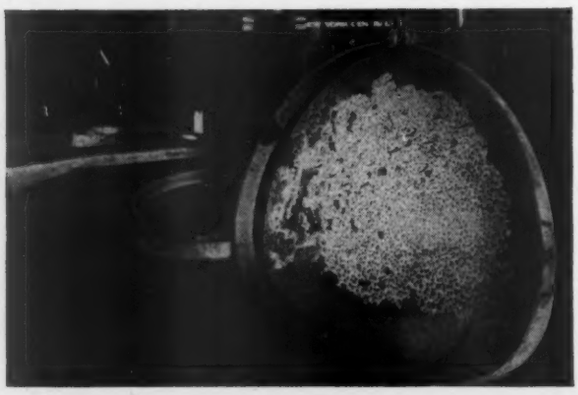
Other locomotive work formed hot includes valve head casings and cylinder head casings, boiler front doors and cinder shields. Boiler fronts and doors are $\frac{1}{2}$-in. material while cinder shields are $\frac{3}{8}$ in. thick. Some fronts are done complete in one operation; others require two. Combustion-chamber-type rear tube sheets are of $\frac{1}{2}$- and $\frac{9}{16}$-in. material; they are heated, placed in dies and flanged in one opera-

A rear tube sheet showing the two offsets which are formed cold and the portion of the flange put in cold—The remainder of the flanges extending along either side to the bottom are put in by hand after heating while the sheet is held in the press

Cold pressing the upper offset in a rear tube sheet



Removing the finished boiler front door from female die



Combustion-chamber tube sheets like the one on the right are placed in dies, pressed, heated and flanged in one operation—At the left are two boiler front doors, and a door sheet with an O'Connor-type offset hole

tion. Engine-truck and tender wear plates of ½-in. and ⅝-in. material with flanges from 3½ in. to 4 in. in length are formed in dies.

Included in the tender work flanged hot on the hydraulic press are tank wells which are flanged in dies in two operations. One set of dies is used partly to form the depression in the first operation. A second set of dies, which uses the same female but a different male die, finishes the operation. The material is heated separately before each operation, and the edges are straightened after completing the second operation. Pedestal jaw shoes for both locomotive and tenders are flanged in one operation in dies; those less than ⅜ in. thick are done cold, over ⅜ in., hot.

Dies are used for cold flanging tank sheets up to ⅜ in., pilot steps, waist sheets and firebox expansion sheets, and trailer-truck fulcrum wear plates up to ⅝ in. Trailer truck fulcrum wear plates above ⅝ in. thick are flanged hot. Pilot steps are flanged cold, but are heated and straightened by hand after flanging.

Parts for electric locomotive boilers done on the hydraulic press include the bottom tube sheet in one operation in dies, and the bottom furnace sheet which is heated and formed in two operations. Miscellaneous forming jobs are also performed for shop equipment, such as ⅝-in. air reservoir heads for shop air systems.

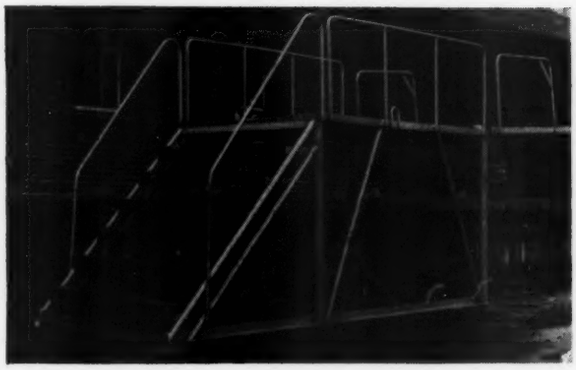
Three men, one mechanic and two helpers, are employed on the hydraulic press for all work.

Two Front-End Work Platforms

Two front-end work platforms which contribute to safety and greatly expedite repair operations on steam locomotives at the Bayshore, Cal., shops of the Southern Pacific are shown in the illustrations. The smaller of these is particularly helpful for light general work and in shops with limited clearance space between locomotive front end and shop wall.

The 2-in. plank platform, about 2 ft. wide by 9 ft long, is supported on two welded bracket assem-

Easily-applied platform for light work in steam locomotive front ends.



Wheel-mounted platform for the removal and re-application of boiler flues and superheater units

blies bolted to the smokebox ring. Each bracket carries an angular wing and three 1⅛-in. pipe nipples, 6 in. long, set vertically to position and hold in place the guard rail which is made of ¾-in. pipe.

The back guard rail comprises both a top and intermediate horizontal pipe section with four vertical pipes to stiffen the construction. An ingenious slip joint design permits shortening or lengthening the guard dependent upon whether the brackets are applied to a small or large smokebox.

A hinged wing guard at either end of the back guard may be swung at right angles to it and held in one of the pipe nipples, thus giving complete protection at the platform end. If preferable, the wing guard may be set at an angle in another nipple and thus give access to the running board, this position being shown in the photograph.

The left bracket of this device also carries a ⅞-in. round bar properly stiffened and designed to support the hook end of a 96-in. step ladder which carries a light hand rail on one side and metal points at the bottom to prevent sliding.

Just enough unobstructed space is allowed in the back guard to permit entrance of a workman to the platform by stooping slightly.

The other front-end work platform, mounted on wheels, is anchored to the smokebox ring and effectively used in removing and re-applying both boiler tubes and flues and superheater units. The units, particularly, sometimes demonstrate great affinity for the locomotive boiler and can be pulled out only with the greatest difficulty. Under this condition, as well as normal front end work, a large, firm and safe working platform is a real asset in any locomotive shop.

This platform, also made at Bayshore shops, consists of three principal parts, namely, the main platform 5 ft. by 8 ft., a 5-ft. by 5-ft. hinged apron on one end of the platform and a set of stairs on the other. The platform, 6 ft. 6 in. above the rail, is mounted on a frame with four motor truck wheels, permitting it to be moved on standard gauge tracks from the locomotive to where tubes or units are worked in the boiler shop. The platform can also move from one shop track to any other via the transfer table, or be lifted directly across from one track to another, if desired, by means of the shop overhead traveling crane with two hooks engaging U-bolts welded to the platform sides at a point near the center of gravity.

The main platform may be made wider and longer, if desired, for use with larger power. The steel frame is an all-welded construction, comprising four vertical columns made of 4-in. scrap boiler flues, welded at the top and bottom to 3-in. steel angles, as illustrated. Bracing is made of 2-in. scrap boiler tubes and guard rails of 1-in. handrail pipe. The apron is connected to the main platform by two substantial hinges which permit raising the apron slightly, if necessary, for attachment to smoke box rings at the most convenient elevation.

Eighteen 2-in. by 12-in. planks are used in the main platform and apron floor and seven in the steps which are kept the full width of the platform for greater convenience of access.

Cylinder Cock Removing Jig

The enginehouse personnel on the Texas & Pacific at Marshall, Tex., have constructed a ratchet-type removing jig to ease the task of removing both air- and steam-operated cylinder cocks. The device is essentially a long-handled wrench, the end of which slips over the cylinder cock from the bottom and permits the mechanic to remove the cock without having to crawl underneath the protruding cylinder.

The device consists of two parts which fit together to form a ratchet wrench. The handle is made from a length of strap iron ½ in. by 2 in. and about 3 ft. long. A rod mounted on the handle engages notches cut in the circumference of a circular plate that forms the base for gripping the cylinder cock. The rod is held in place in a notch by a spring and is released from contact by a bell-crank lever which is squeezed against the wrench handle to withdraw the rod from the notch.

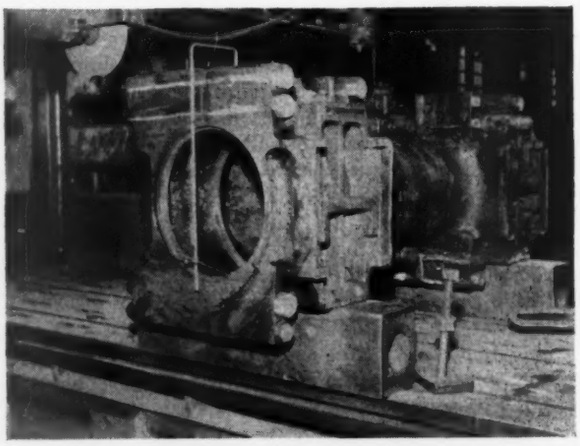
Ratchet-type cylinder-cock application and removal jig

Two steel bushings are welded to the handle. One is about ¼ in. and the second about 2 in. from the edge of the circular plate. Each bushing is 1 in. long, and through both bushings there is a pin ⅝ in. by 6 in. Between the bushings there is a compressed spring which holds the pin in the notch on the circular plate. The end of the pin is connected to a rod ⅛ in. by 1 in. by 20 in., the other end of which is connected to one end of a bell crank. The bell crank is moved by a lever which is mounted on the edge of the wrench handle; squeezing the lever on the bell crank withdraws the pin on the other end of the rod from engagement with the notch and permits the handle to be turned to another notch for unscrewing the cylnder cock.

The wrench handle is bolted loosely through a filler plate to the notched circular plate to permit easy turning of the handle with respect to the plate for engaging successive notches. The notched plate is ⅜ in. thick and 10 in. in diameter. Two posts are welded to the plate far enough apart to permit the posts to slip around the body of the cylinder cock. As the circular plate is turned by the handle they engage the ends of the cock and turn it for removal or application.

Two different heads are used for the removal of the two types of cylinder cocks; they differ only in minor respects necessary to fit the type of cylinder cock which they will be used to remove.

Roller bearing housing mounted on horizontal planer preparatory to grinding liner faces and prior to alignment and clamping in position—The shop-built grinding attachment is shown at the upper left



The distance from the race to the liner is found by a surface gauge and a dial indicator attached to an L-shaped rod—The housing is aligned by setting the surface to which the liner is welded parallel to the parallel blocks

Grinding Roller Bearing Liner Faces

A horizontal planer at the Pine Bluff, Ark., shops of the St. Louis-Southwestern, to which a grinding attachment has been added grinds steam locomotive roller bearing main pedestal liners parallel to each other and equidistant from the outer race. The housing rests on two parallel blocks set on the planer bed and is leveled by small wedges. The alignment is made by measuring the distance from the parallel blocks to the surface to which the liner is welded as this surface was not subject to wear.

The first step in refinishing the liners is to clean all surfaces thoroughly so that grease will not clog the emery wheel or interfere with the alignment for grinding. The thinnest liner is then determined by measuring from each liner wearing surface to the farthest portion of the roller bearing race. The entire housing is placed on the two parallel blocks with one liner from each box resting on each block. Opposite corners of opposite liners are set equal distances above their respective parallel blocks. The thin liner is then ground. After grinding it is checked by placing a parallel bar across the ground surface and "miking" the distance from the bottom of the bar to the top of the block. A total variation of .002 in. is allowed from one end to the other. After the thin liner checks satisfactory, the top liner on the opposite box is aligned, ground and checked. The housing is turned over to rest on the finished liners and the remaining two liners are ground. New micrometer readings are stenciled on all four surfaces to which the liners are welded.

The measuring gauge for determining the thinnest liner and checking the ground surfaces consists of a standard 3½-in. case-hardened surface gauge and a light-weight dial indicator joined to opposite ends of an L-shaped rod. The parallel blocks are 6 in. by 7½ in. by 32 in. The grinder is bolted to a horizontal leg 11 in. long of an L-shaped 1⅜-in. plate 10 in. wide. It is held to the L-shaped plate by four ¼-in. bolts and by a ⅝-in. diameter U-clamp which is threaded at the two ends and fits over the motor. The legs of the U-clamp are joined by a plate 7/16 in. by 1½ in. by 14 in. The 18-in. vertical leg of the L-shaped plate is bolted to the vertical face of the cross rail tool post holder of the planer with four ⅞-in. bolts. The grinder is moved along the rail with the regular machine feed.

QUESTIONS AND ANSWERS

Air Brake Questions and Answers

The 24 R L Brake Equipment for Diesel Electric Locomotive

AUTOMATIC SERVICE POSITION

Q-796—What does this position produce? A.—The proper rate brake pipe pressure reduction to cause a service brake application.

Q-797—How is this reduction accomplished? A.—The exhaust port in the rotary valve seat registers with passage *4*, allowing air from chamber *D* and the equalizing reservoir to escape to the atmosphere. The fall of pressure in chamber *D* causes the higher brake pipe pressure in chamber *N* to move the equalizing piston to the left, carrying attached lever *79*, which is rotated to compress spring *83* and unseat the equalizing discharge valve. Brake pipe air from chamber *N* and passage *2b* then escapes past the unseated discharge valve to passage *15*. In service position brake pipe air from passage *15* flows through a choke to passage *16* which is connected to the exhaust passage by a port in the rotary valve seat.

Q-798—What is the purpose of a choke? A.—To restrict the air flow so that the pressure in the brake pipe as well as in the equalizing reservoir are reduced at a controlled rate, which serves to prevent quick action.

Q-799—How is the brake pipe reduction reflected at the control valve service portion? A.—When the reduction takes place on the face of the service piston, auxiliary reservoir pressure in chamber *C*, the piston moves to the right, first moving the graduating valve, disconnecting graduating valve passage *B* from slide valve passage *19*, cutting off supply of emergency reservoir air to the auxiliary reservoir. (In direct release operation).

Q-800—As the service piston moves further to the right what happens? A.—It moves the slide valve which: (a) Disconnects slide valve port *K* from on the right side of release insuring valve *150*. (b) Disconnects slide valve port *E* from seat port *13*, cutting off auxiliary reservoir air to the chamber on the left side of release piston *110*. (c) Connects seat port *7* and seat port *13* to cavity *A* in the slide valve and the exhaust passage in the slide valve seat.

Q-801—What results from this connection? A.—This permits auxiliary reservoir air in chamber *D* in the right side of the release piston to overcome spring *120* and move the piston and release slide valve to the left, thereby disconnecting displacement reservoir passage *3a* from exhaust passage *10* to permit development of pressure in the displacement reservoir.

Q-802—What other connections are made by the slide valve? A.—Connects graduating valve port to slide valve cavity *D* and slide valve seat passage *3c*, which permits auxiliary reservoir air to flow to service choke *3* and passage *3a*. From passage the auxiliary reservoir air flows past diaphragm valve *199* to passage *3* and out pipe *3* to the displacement reservoir at a rate controlled by service choke *3*. Auxiliary reservoir air from passage *3* also flows past check valve *252*, through passages *28*, *36* past check valve *252b* and passage *16* to the relay valve.

Q-803—Is the safety valve connected in service position? A.—Yes. Referring to Plate *B*, passage *3h* is connected to passage *3a* at emergency choke *4*, passage *3h*, cavity *S* and passage *17*.

Q-804—What other connection comes from passage 3h? A.—Passage *3h* is also connected to the controlled emergency portion, chamber *A*, and with the rotair valve in freight position, auxiliary reservoir air from passage *3h* flows past unseated check valve *185* to chamber *D*. In service application auxiliary reservoir air from passage *3a* aids spring *209* in holding diaphragm *201* and its valve to the left and flows unrestricted to passage *3* before the air in chamber *D* can build up to move the diaphragm and its valve to the right.

Q-805—What happens as the release piston 110 and its slide valve move to application position? A.—Seat passage *22* is blanked preventing back flow from emergency reservoir to chamber *D*.

Q-806—What is the result of the service reduction in chamber B on the face of the emergency piston? A.—Quick action chamber air in chamber *E* cause the emergency piston and graduating valve to move to the left until the piston spring guide contacts the slide valve. In this position the piston closes charging choke *22*, and vent port *t*, through the graduating valve, registers with exhaust port *v* in the slide valve. This allows quick action chamber air to flow to the atmosphere, reducing quick action chamber air at a rate to keep it from attaining a differential over the brake pipe pressure sufficient to move the piston and compress the spring *34* enough to cause the graduating valve to open port *t*, and cause an emergency application.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Welding Staybolts

Q.—When seal welding screwed-type staybolts to the firebox plates should the weld be continuous around the full circumferences of the bolt?—M. E. F.

A.—The practice for seal welding staybolts varies to some extent on the different railroads. One practice is to seal weld the bolt heads with ⅛-in. reverse-polarity welding rods, starting the weld on side bolts at the top center, welding down to the bottom center, then clean the starting and stopping ends of the weld of all flux and complete the weld from the top downward. On some railroads this procedure is reversed, in that the welding is started at the bottom center, welding upward around the bolt to the top and always finishing the weld at the top of the bolt. On overhead bolts the weld is started at any point with a continuous weld for the full circumference of the bolt.

Blow-Down Savings

Q.—Is the cost of continuous blow downs and the blowing down of the boiler that goes along with water treatment justified from the standpoint of the fuel used in heating the water discharged from the blow-off cock?—R. E. V.

A.—The cost of the fuel used in heating the water discharged from the blow-off cock in connection with water treatment is more than offset by the saving in fuel in that the heating surfaces of the boiler are kept clean. The loss of fuel due to a ⅛-in. layer of scale on the heating surfaces may be as high as 15 per cent. Also, there is a saving made possible by the elimination of excessive water changes resulting in better availability of power, in that the washout periods can be extended by the use of water treatment. Eliminating the cost of washouts is a direct saving of the fuel required to heat the water from its initial temperature to operating temperature after each washout or water change.

A direct saving of fuel is also obtained in that the superheater is more efficient when the steam entering the superheater is relatively dry as compared to a boiler where the water is carried over into the dry pipe due to foaming.

Diesel Locomotive Questions and Answers

By J. R. Benedict

Identifying Symbols

Q.—Will you explain what the symbols: A1A, A1A-A1A, B-B, 4 (B-B) and C-C mean when used to designate the wheel arrangements of Diesel locomotives? Do they refer to any particular type of service such as switching, passenger and freight?

A.—For steam locomotives the Whyte system was a very satisfactory method of designating wheel arrangements. The 4-6-2 designating numerals, as an example, were understood easily and clearly described the Pacific-type locomotive wheel arrangement with its four-wheel leading truck, six driving wheels and two-wheel trailing truck. This same system applied to a Diesel locomotive can not be used to indicate the wheels that are driving wheels and those that are idlers in any one wheel group. A 6-6 Diesel locomotive, using the Whyte symbols, would indicate a unit with two pairs of six-wheel trucks but does not indicate which wheels are driving and which are idlers.

Thus, the Continental system is used for Diesel locomotives. This system uses letters to designate driving wheels and numerals to indicate idling wheels. The letter "A" designates one pair of driving wheels. "B" indicates two pairs, "C" three pairs, "D" four pairs, etc. The numeral "1" designates one pair of idling wheels, "2" shows two pairs, etc.

Therefore the symbol A1A indicates a six-wheel truck with one pair of driving wheels on each end and a pair of idler wheels in the middle. The symbol A1A-A1A designates a Diesel unit with two six-wheel trucks of the type just explained. The symbol B-B designates a Diesel unit with two four-wheel trucks having all wheels driving. The symbol 4 (B-B) is used to designate a four-unit locomotive with each unit having two four-wheel trucks with all wheels being driving wheels. A 2 (B-B) would be a two-unit locomotive with the same type of trucks. The symbol C-C indicates a unit with two six-wheel trucks having all wheels driving.

These symbols do not, of course, indicate the type of service. A system that could be used also to describe the locomotive as either a switching, pas-

senger or freight locomotive might be desirable but would not be very satisfactory. Many locomotives are used for more than one type of service, some are considered all-purpose locomotives, and certain types of locomotives can be readily converted for a different type of service by changing the gear ratio.

Electric Dynamic Braking

If the electric dynamic brake fails to operate properly on FT and F3 Electro-Motive locomotives so equipped, it will be necessary to examine, first, the low voltage field loop circuit of the main generator battery fields of all units and, secondly, the high voltage dynamic braking contactors traction motor field circuits.

Q.—What procedure should be followed to locate the cause of failure of the dynamic brake on all units of the locomotive?

A.—Check the field loop circuit. The following is a tracing of the field loop circuits as applied to FT and F3 class locomotives. Electricity leaving the positive side of the auxiliary generator knife switch or batteries flows through an 80-amp. battery field fuse (located in the low voltage cabinet or panel), the brake control 31-bar contacts and resistors, the unit selector switch and resistors; (FT) field loop contacts *cd* and *ef* normally open, now closed; (F3) field loop contacts *ab* and *cd* normally open, now closed; cam switch contacts *jk* and *nm* normally open, now closed, battery field contact normally open, now closed. The electrical field loop circuit as listed above is completed in the front operating cab unit. In all units it will be necessary to examine the above, plus the cam switch contacts *jk* and *nm* normally open, now closed, battery field contacts normally open, now closed, and in rear trailing cab unit; (FT) field loop contact *ab* normally closed, now closed; (F3) field loop contact *ef* normally closed, now closed, plug couplers, and jumper cables. Note: On locomotives whose last trailing unit is not a cab unit, a shortening bar is used to complete the field loop circuit. This shortening bar takes the place of (FT) field loop contact *ab* or, (F3) field loop contact *ef* on rear cab unit. This shortening bar must be closed and making good electrical contact or the field loop circuit will not be completed.

In tracing the field loop circuit just described, if the circuit is not completed electrically, check all contacts, fuses, switches, etc., to determine if they are electrically sound.

a. The 80-amp. battery field fuse located in the low voltage panel or cabinet must be checked. Make sure its contact clips are tight and clean.

b. The brake control 31-bar commutator must be examined. Check all brushes for being broken and making poor contact, dirty bars, dirty or grounded resistor wires, or poor contact at terminal board.

c. The unit selector switch must be in the proper position for the number of units comprising the locomotive. Examine the contacts on this switch and their 1.2-ohm resistors; if used, to determine if it is electrically sound.

d. If the field loop contactor fails to operate, check the field loop operating coil, its wires and contacts, fourth and fifth fingers of the reversing control, fifth and sixth fingers of the transition control drum type switch, 30-amp. control fuse and control push button, to determine if they are tightly closed and in good electrical condition.

Q.—If the cam switch fails to operate to the TOW position, what is the position of the interlocks?

A.—Class FT: Examine the TOW operating coil and its wires, brake relay interlock *ab* normally open, now closed, (if brake relay interlock fails to close, examine the brake relay operating coil, fifth and sixth fingers of the transition control and its wires), *P2* interlock *cd* normally closed, *P4* interlock *ab* normally closed, fifth and sixth fingers of the transition control drum type switch, and 30 amp. control fuse and push button. Examine the cam switch for foreign objects that would bind its contact movement.

Q.—If the battery field contact fails to close, where can the trouble be located?

A.—Examine the battery field operating coil and its wires; (FT) cam switch interlock *ef* normally open, now closed; (F3) cam switch interlock *cd* normally open, now closed; also fifth and seventh fingers of the transition control drum type switch.

Q.—What is the procedure in locating the failure of the operation of the dynamic brake contactors?

A.—The high-voltage dynamic-braking contactors in the traction-motor field circuit must be electrically sound. Examine the B1, B2, B3 contacts to determine if they are tightly closed and in good mechanical condition. If these contacts are not closed, examine the electrical circuits to their contacts operating coils.

Class FT: Check the fifth and sixth fingers of the transition control drum type switch, brake relay interlock *ab* normally open, now closed, *P1* interlock *ef* normally closed, series interlock *ab* normally closed, *P2* interlock *cd* normally closed, reverser interlock *ab* normally closed, cam switch interlock *gh* normally open, now closed, *B1 - B2 - B3* operating coils, fifth finger of the isolation switch and all points of contact and wires to these interlocks and operating coils to determine if they are electrically sound.

Class F3: Check the fifth and sixth fingers of the transition control drum type switch, *P4* interlock *ab* normally closed, *P2* interlock *cd* normally closed, brake relay interlock *ab* normally open, now closed, cam switch interlock *ef* normally open, now closed, reverser interlock *ab* normally closed, dynamic braking contactors operating coil, No. 5 finger of the isolation switch, and all points of contact and wires to these interlocks and operating coil to determine if they are electrically sound.

If the electric dynamic brake fails to operate on all units, the trouble will usually lie in the field loop circuit. If the electric dynamic brake fails to operate on only one unit, it is an indication that the field loop circuit is complete and the trouble will usually be found in the dynamic brake contactors in the traction motor field circuit.

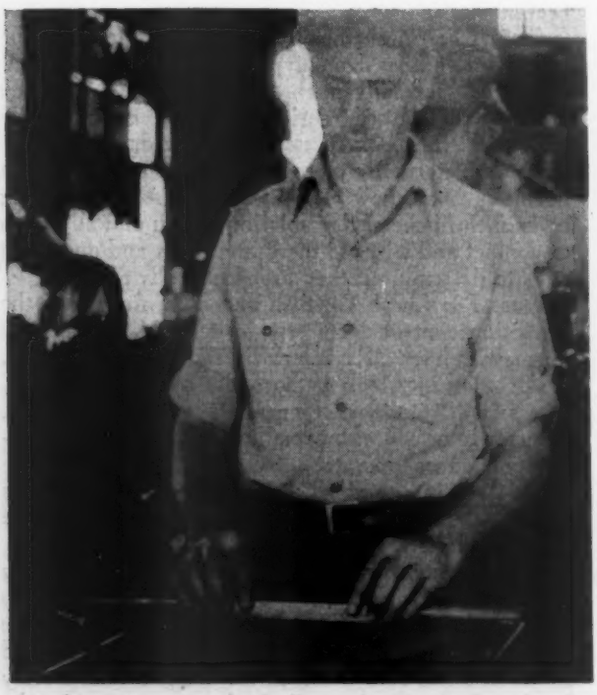
CAR INSPECTION AND MAINTENANCE

Conditioning Slide Valves and Seats*

By L. S. Bean†

ONE of the most perplexing problems in the past has been that of controlling the friction between the slide valve and slide valve seat to a degree that the operating valve, whether it be a triple, a universal or any other valve, will control the air properly from the brake pipe to the brake cylinders, and from the brake cylinders to the atmosphere. The old method of merely cleaning the valves and applying lubrication to the slide valve and seat, making a seal that will allow the valve to pass the code of tests on the leakage test, and at the same time temporarily allow the valve to operate freely as long as the lubrication is present, can no longer be practiced unless without danger of causing great damage in the handling of trains.

* Abstract of a paper presented before the Air Brake Association in Chicago, September, 1948.
† Air Brake Supervisor, Missouri-Kansas-Texas.



Truing and charging the lap stick on a cast-iron lapping plate 15 in. in diameter.

Lapping the slide valve seat for the various air brake valves by the use of block tin lap sticks has definitely been proven efficient and the best method of reconditioning these valves, some of which are required to remain in service as much as 36 months, and must operate with relatively identical effect during that entire period with the minimum friction and leakage required. There have been some who are interested in air brake maintenance who have endeavored to adopt this method, but have found it difficult to train their repair men to master the skill of handling the lap stick with satisfactory result. Even repair men who have become expert in handling the lap stick often lose the proper touch and find it difficult to regain the accuracy required.

When the method of using these lap sticks was first adopted the men who were assigned to the work of finishing slide valves and slide valve seats were experienced air brake repair men and they had little difficulty in mastering the use of these sticks because of their former practice with files and other lapping methods. War conditions and the rapid changing of men from one job to another brought the serious problem of securing men proficient in precision work. At that time the idea was conceived of using a tool that fastens to the valve body and which supports two rollers over the center of the slide valve seat. The body-fastening device is equipped with an adjusting screw which allows adjustment of the rollers and causes them to work on the back or top side of the lap stick with just sufficient pressure to prevent the rocking of the stick and to assure proper abrasion.

The development of this tool has removed the human element in the use of the lap stick to the extent that the operation is possible, and the most suitable type of slide valve finishing can be accomplished by men who are untrained in the precision of air brake repairs. The tools are so designed that they can be applied to the valve in less than ½ minute. By reason of the different designs of the various valves it was necessary to design a pressure-holding device for each particular class of valve.

The tools described are now being used in the M-K-T Air Brake Shop at Parsons, Kan., on the AB control valve, service portion and emergency portion, the K-1 and K-2 triple valves, the equalizing and quick-action portions of the universal control valve, and the equalizing and application portions of the 6K and 6KA distributing valve. The method can be made to apply to all air brake equipment of the slide valve type.

The valves are dismantled by helpers and the various parts are cleaned thoroughly by washing in Oleum spirits. The die casting parts are submerged in Oakite No. 10. The body of the valve is buffed on motor-driven wire-wheel brushes, and all brass parts, excepting pistons, are cleaned in an acid solution. The valves are delivered to the mechanics in a clean condition.

Care is taken that the lap stick is of proper width to just pass through the bushing with a minimum of clearance, that there is no taper in the stick, and that both ends of the stick are of the same thickness so the roller pressure will be the same for the entire stroke through the bushing. After the block tin is poured on the surface of this stick it is machined for width and thickness on the shaper; the back side of the stick is ground on a surface grinder to assure uniform thickness.

A cast-iron lapping plate 15 in. in diameter, New York Air Brake Company piece No. N-2512, Westinghouse Air Brake Company piece No. 99388, is used for truing and charging the lap stick. These lap plates must be kept true and not allowed to become hollow in the center as they are inclined to do after a period of use.

After truing and charging the stick on the plate on which Grade FF Silicon Carbide is sprinkled, a few drops of metal polish (Quick Shine preferred) is placed on the stick and spread evenly with a clean cloth. It is then blown dry slowly with a small jet of compressed air. While truing and charging the stick, care must be taken to grasp the stick in the center and not bear down on the handles; to do so is liable to spring the stick and cause it to become high in the center.

The stick is placed in the slide valve bushing and the roller device adjusted by the adjusting screw to sufficient pressure to secure the stick to the seat and prevent it from rocking. The stick is passed through the valve from 12 to 15 strokes and is then removed and recharged on the lapping plate to remove the metal that has been picked up. The foregoing method is repeated until the valve seat has attained a highly polished finish.

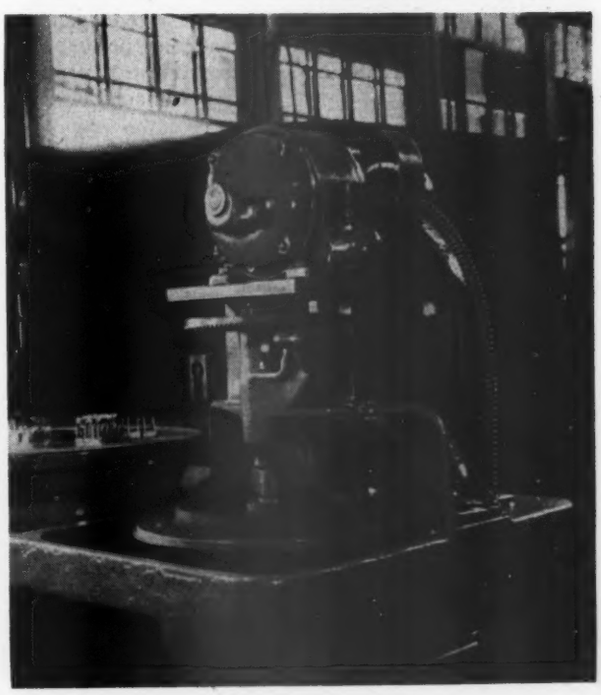
Some slide valve seats will be found in such shape to necessitate roughing the seat down with a lapping block upon which No. 280 grit abrasive paper has been fastened by means of clamps on each end of the stick which stretches the strips of paper tightly. Several layers of paper are clamped to this stick; when the first piece has worn it is torn off, and the next sheet is ready for use. Valves returning to the shop for cleaning after undergoing this method in the preceding shopping should need only a few strokes of the block tin lap stick to restore the seats to their former polished state.

After the slide valve seat has been conditioned, the body and bushing and the entire valve is blown free of all dirt and abrasive cuttings. A slide valve and graduating valve is selected from a tray of valves conditioned by another mechanic specialized in that procedure and applied to the piston. Powdered graphite is applied to the slide valve and its seat and to the graduating valve and its seat by means of a wood paddle upon which a chamois is glued. The piston ring which has previously been worked by another mechanic specialized in that operation is then lubricated and placed in the valve and the valve passed on to the assembling bench for completion.

The slide valves and graduating valves, in fact all flat seat valves, including the brake valve seat and rotary valves, Okadee cylinder cock seats, oil burner tips and bodies and various other valves, are conditioned at this station.

The lapping machine shown used is a semi-automatic valve-finishing machine equipped with three lapping plates. While one plate is conditioning valves, two plates are in the process of truing by means of a cam revolving the top plate in a circular

Semi-automatic valve finishing machine trues two lapping plates while a third is conditioning the slide valves



and eccentric motion over the stationary lower plate. Silicon carbide, grade FF, is used between these plates.

The plate that is being used to condition the slide valves revolves in one direction and the carrier plates (designed to suit the various-type valves) turn in the opposite direction. The lapping plate is slightly out of center with the revolving carrier plate, which prevents the valves being lapped from following the circle on the plate and tends to move the valves to and from the center of the plate, thus resulting in a more even distribution of the abrasive used. For this operation Carborundum H-40 medium finishing compound is used between the plate and the valves being lapped.

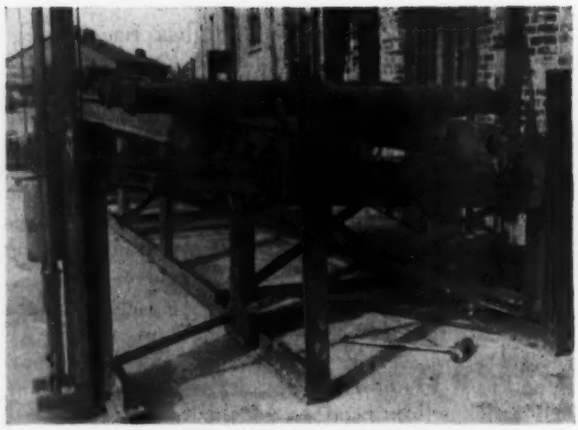
After the slide valves have been lapped, and during this machine operation, the operator is conditioning the graduating valve seats by virtually the same process as used on the slide valve seats, except that he holds the lapping stick stationary and passes the valve over the stock. The lap sticks used in this operation are charged on the cast iron plate with grade FF Silicon carbide. Metal polish is applied and used in the same manner as in the slide valve seat operation.

Before the slide valve and graduating valve is matched up and placed in the tray for delivery to the mechanic for application it is given a final polish on a block tin plate 15 in. in diameter which has been charged with grade FF Silicon carbide. After the bulk of this abrasive is blown from the plate the metal polish is applied and blown dry. The operator at this station has in his possession the various condemning gauges for the parts that are conditioned, and it is his responsibility to pass judgment on the correctness of the valves handled by him.

This method of conditioning the slide valve and slide valve seat is the product of several years experimenting on the part of those of us who are associated with the air brake problems on our railroad. This method has been adopted because it has proven to be the best means of securing the type of finish that the valves have when they leave the manufacturer without the aid of expensive machinery.

Axle Handling Device

Handling of axles by hand between the outside storage rack and the axle journal lathe has been eliminated at the Centralia, Ill., shops of the Illinois Central by the construction and installation of automatic means of transferring the axles between these points. The arrangement consists of an outdoor axle storage rack which slopes one inch in three feet; a tripping mechanism for holding the axles on the outdoor rack or releasing them as desired; a 9-in. channel 30 ft. long with a slope of one inch to the foot on which runs a four-wheel dolly that carries the axle from the outdoor rack to the inside of the shop; a second tripping mechanism to eject the axle from the dolly onto the indoor storage rack near the journal lathe and a counterweight to return the dolly to the top of the gravity feed track to repeat the transporting cycle.



The outdoor storage rack and the upper portion of the 9-in.-channel transfer track of the automatic axle-handling arrangement—The axle in the foreground is shown resting against the two bolts which are held in the protruding position above the I-beam by springs—Releasing a lever under the top left end of the sloping track retracts the two stops and allows the axle to fall on the four-wheel dolly and be carried into the shop—After dropping the axle on the inside storage rack the dolly is returned to the loading position by the counterweight shown at the left

The complete cycle begins by loading the axles with a crane truck on the outdoor rack, from which they can be fed to the inside of the shop for journal turning as needed. The axles are free to roll by gravity down the storage rack to within about a foot of the four-wheel dolly which carries the axle to the inside of the shop. At this point the forward axle is restrained from moving further down the rack by two bolts 1⅛-in. in diameter that protrude about 1½-in. above the top surface of each of the two I-beams which comprise the top of the outdoor storage rack and on which the axles rest while awaiting transfer. The bolts are held in this position by a spring, and are released by a handle located on the front of the rack connected to the bottom of each bolt through a series of levers.

As the spring stops are released the axle rolls down the remaining foot of the storage rack and drops onto the dolly, which has been held by a counterweight at the top of the channel track in the proper position to receive the axle when dropped from the rack. As the axle drops onto the cart the combined weight of the two is sufficient to overcome the retarding force of the counterweight, and the dolly begins its descent down the track.

As the dolly approaches the lower end of the sloping track, it hits a tripping mechanism which rolls the axle clear of the dolly and in place on the indoor storage rack from which the axle can be loaded into the lathe by a hoist. The tripping mechanism consists of two levers connected about half way between the pivot point and the free end in such a way that both must move together in the same circular direction—clockwise or counterclockwise. The lever nearest the bottom of the track is at a right angle to the track, while the lever up

The position at which the axle is discharged from the dolly on the inside storage rack—The axle-ejection system is shown on the right hand side of the rectangular stand made from the angle section—As the forward end of the dolly hits the lever on the extreme right, lever on the left is actuated by a rod connected to the right hand lever and pushes the axle clear of the dolly and onto the two wooden racks behind the channel track—From this point the axle is mounted on the journal lathe by the hoist shown in the center of the picture

the slope, which contacts the axle, is nearly parallel with the track. Thus, as the forward end of the dolly hits the lever perpendicular to the track the second lever is moved so as to cause the axle to roll clear of the dolly and onto the wooden storage rack.

After the axle has been ejected from the dolly, the force applied by the counterweight becomes sufficient to overcome the weight of the dolly alone and the dolly returns to the top of the track to receive the next axle. As the dolly is returned to the higher position on the track the tripping mechanism at the lower end of the track is returned to its original position by a spring and is ready to receive and eject the next axle.

As the dolly is returning to the reloading position, a projection on its upper end trips the stop bolts automatically, permitting the next axle in the row to roll upon the dolly and repeat the cycle. Thus only one manual operation is required to load any number of axles up to the storage capacity of the outdoor rack. After the stop bolts have once been released by hand to load the first axle, the axle-handling arangement will continue to function automatically until the last axle on the rack has been moved indoors. At this point it will stop automatically. When no axle falls on the dolly, the dolly is held at the top loading position by the counterweight. The counterweight, which by a double pulley arrangement exerts a force greater than that of the empty dolly but less than that of the dolly plus the axle, is mounted on the 9-in. vertical channel which forms the end support for the handling arrangement. Because of the double pulley arrangement, the height of this column need be only some 15 ft. to povide sufficient travel for the counterweight to control the movement of the dolly along the 30-ft. sloping track. The counterweight moves up and down along a vertical path formed by two rods which serve as guides; it is restrained to the path of the two rods by two 1-in. pipes welded to the counterweight which fit around the two guide rods with sufficient clearance to permit free travel. There are four springs, one on the top and bottom of each of the two guide rods. These serve to cushion the counterweight at the ends of the stroke.

Aluminum Passenger Car Parts

Methods and equipment for fabricating aluminum are becoming more important due to the increased use of this metal in modern railroad cars and their accessories. Two important tools used by the Union Pacific in the production of aluminum furniture and other equipment, are the oxy-acetylene blowpipe for bending and the Heliarc inert-gas welding process.

This welding process utilizes a virtually non-consumable tungsten electrode which is brought close to or in contact with the metal to start the arc. An inert gas, usually argon, flows at low pressure from a cup that surrounds the electrode and this gas blankets the molten weld metal, protecting it from the atmosphere. Filler-rod metal is manually applied to the weld zone the same as in oxy-acetylene welding.

The chair frames, shown in Figs. 1 and 2 are made from ¾-in. and 1-in. square aluminum tubing that is received in 14- to 20-ft. lengths. A power

Fig. 1—Using a standard blowpipe fitted with two welding tips, the operator is heating aluminum tubing as it is being bent on the jig

saw is used to cut the stock into desired lengths for the chair parts. The next step is bending the cut parts which is done on shop constructed jigs. Where the curves are not sharp the bends are made cold. For sharp bends the double-tip oxy-acetylene blowpipe with two No. 12 tips is used. In hot bending, the tubing is filled with sand held in by a plug at each end, and the quick even heat of the oxy-acetylene flames permits neat uniform curves at a rate of 2 minutes per bend. In the lounge chair, six hot and two cold bends are made.

In welding aluminum chair parts, the Heliarc process may be used to produce high-quality welds. There is no problem of flux removal and the grinding and polishing operations are therefore kept to a minimum. Most of the welding is done with alternating current using 150 to 175 amp. and 10 liters per minute of the blanketing argon gas. The tungsten electrode for this type of work is ⅛ in. in diameter and bare aluminum rod (Oxweld No. 23) is fed into the welding puddle as required. To produce the lounge chair shown in Fig. 2, 22 welds are required, each of which takes from 3 to 4 min. to make.

After the lounge chair frame has been welded, such work as dressing down, polishing and lacquering consumes about two hours more.

Fig. 2—Lounge-chair frames which have been "Heliarc" welded and all joints ground to surface and buffed

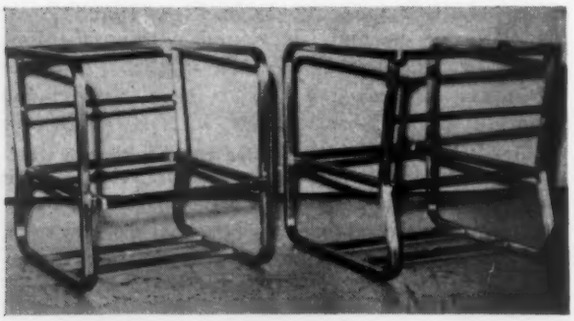


Fig. 3—Using a multi-flame nozzle, the operator is heating and bending a rounded-corner door frame

Fig. 4—In constructing this 18-8 stainless steel Diesel water tank, Heliarc welding was used to make lap, fillet, and butt welds

Fig. 5—Heliarc welding an 18-8 stainless steel passenger coach water tank

Oxy-acetylene heating is also used to bend the aluminum stock to produce door frames, (Fig. 3) and other car parts. An interesting sidelight on the bending operation is that as the operators become experienced on one application, they can easily apply this experience to other applications. As a result, there is in this shop a growing list of economically fabricated aluminum equipment.

In the matter of operator experience, the same thing can be said of the welding. Both fabrication and repair work of other metals such as stainless, Everdor and Monel, are now readily handled in the shops. For example, Figs. 4 and 5 show the Heliarc

welding process being used to fabricate a stainless steel passenger-coach water tank and also a Diesel water tank.

This and other railroad shops are faced with the fabrication or repair of more and more stainless steel, aluminum and other metals that are difficult to weld and, as this development continues, it is expected that more and more advantage will be taken of the latest modern equipment in welding these materials.

Changes In 1949 Interchange Rules*

By R. W. Hollon

Freight Car Rules

RULE 2

Par. 2—New last sentence added to permit rejection, in interchange, of empty cars equipped with roller bearings in defective condition.

Sec. (f) (Item 2)—Item of "defective journal roller bearing units" included with other excepted items for which transfer authority must be issued.

Sec. (h)—Modified to eliminate certain information called for on form, shown on page 271, covering transfer and adjustment of lading in certain cases where all of the information is not required, as shown in Supplement No. 1.

RULE 3

Sec. (a) Par. (4)—Effective date for application of "AB" brakes extended to January 1, 1950.

Sec. (a) — Par. (6) and (7)—Added with respect to requirements covering air brake pipe clamps of J and U bolt types on cars built new or rebuilt on and after January 1, 1950.

Sec. (b) — Par. (7) and (9)—Effective date for application of metal badge plate showing dimensions of brake levers and requirement for brake power extended to January 1, 1950.

Note following Par. (c-1)—Former note, which authorized use of couplers with former standard grade "B" steel knuckles and locks on new cars built prior to July 1, 1948, eliminated. New note added as shown in Supplement No. 1 to permit acceptance in interchange of cars equipped with AAR Type "F" interlocking couplers, and modified to provide for substitution of such couplers in case of failure and disposition of parts removed.

Par. (c-10)—Modified to prohibit acceptance from owners of cars equipped with former or temporary standard couplers having 5-in x 5-in. shanks. Note following, advising them would be no extension of effective date, eliminated.

Par. (c-11) and (c-12)—Effective dates extended to January 1, 1950. This permits interchange of cars equipped with former standard (except Type D) or temporary standard couplers having 5-in. x 7-in. shanks for another year and allows another year to equip A.A.R. Standard Type E bottom rotary operated couplers with the assembled riveted type lock lift lever and toggle, E-14.

Sec. (d) — Par. (3) and (4)—Paragraph 3 revised to provide requirements for draft key retainers on cars built prior to January 1, 1950, and new Paragraph 4 added which makes mandatory the application of A.A.R. alternate Standard or A.A.R. approved equivalent, on all cars built new or rebuilt on and after January 1, 1950. Effective January 1, 1952, this requirement will apply to all cars, in interchange, from owners.

Sec. (j)—New note added following Paragraph (1), to provide for the interchange of cars equipped with journal roller bearings.

Sec. (j) (3)—New paragraph added making mandatory the use of journal box lids complying with A.A.R. specifications as revised in 1947, on all cars built new or rebuilt on and after January 1, 1950, as shown in Supplement No. 1. The A.A.R. approved types of lids are identified by marking "A.A.R.-1947" and those approved to date are listed in Rule 101, Page 211. When "A.A.R.-1947" lid is applied to a foreign car, repair card must show type designation to justify charge.

Sec. (r) (7)—Modified to indicate specifications for running boards other than wood were again revised in 1948. Note 1 modified to indicate dome steps and dome platforms for tank cars must comply with specifications for Tank Cars. Note 2 modified and various approved types of running boards indicated in Groups 1, 2 and 3. Specifications in Sec. (3), 5th paragraph revised to provide sections of unsupported length up to four feet without exceeding ⅛-in. deflection and over four feet but not more than seven feet without exceeding ¼-in. deflection.

Sec. (t) — Par. (3-d)—Modified to provide for normalizing second hand truck side frames, as required in Section A, General Regulations, Rule 23 and stenciling to indicate frame so normalized, as shown in Supplement No. 1.

Sec. (t) — Par. (3-e)—Modified to permit coating of new or second hand truck sides and truck bolsters with a light bodied paint and to prohibit painting of car wheels. Truck sides and bolsters coated with a heavy base paint or having an accumulation of rust scale, must have paint and scale removed when cars receive general repairs, as shown in Supplement No. 1.

Sec. (t) (3-f)—Effective date, with respect to interchange of cars having truck side frames to which repair patches or reinforcing plates have been applied, extended to August 1, 1949.

Sec. (t) (10)—Effective date for application of metal placard holders, extended to January 1, 1950, as shown in Supplement No. 1.

Sec. (u) (4)—Effective date with respect to acceptance in interchange, from owners of Class E-3 cars, extended to January 1, 1950 as shown in Supplement No. 1.

Sec. (w) — Par. (2)—Modified to prohibit inter-

* Interpretation of new A.A.R. Rules of Interchange, effective January 1, 1949, presented at a meeting of the Car Foremen's Association of Chicago. Mr. Hollon is mechanical inspector, Chicago, Burlington & Quincy, Chicago.

change of cars equipped with double plate cast-iron wheels, or with any type of cast-iron wheel below nominal weight or without weight cast thereon, as shown in Supplement No. 1.

Sec. (w) — New Par. (3) added advising that 700 and 750 lb. single plate non-bracketed cast-iron wheels, cast prior to 1938, will be prohibited on all cars effective January 1, 1950, in interchange. New Par. (4) added advising such wheels, regardless of date cast, will be prohibited on all cars, effective January 1, 1952, an interchange. Second note following modified to eliminate requirements for metal running boards on industrial or other cars not intended for interchange service, as shown in Supplement No. 1.

Rule 4

New Note 4 added following Sec. (d), to clarify intent exterior fire damage on wooden parts of car is cardable even though such damage is to a lesser extent than the limits specified for other cardable damage. New last sentence added to paragraph 6, Sec. (f), to clarify intent exterior fire damage to wood sides or wood ends of gondola cars is cardable, even though such damage is less than the three inch limit specified for holes cut in sides or ends.

Rule 5

First paragraph modified to permit road responsible for additional damage, as indicated by joint inspection certificate, to endorse such certificate in lieu of issuing defect card, as shown in Supplement No. 1.

Rule 7

Sec. (2)—Modified to eliminate unnecessary information on billing repair cards with respect to bolts, paint and nails; where applied price includes these items, number and size of bolts nor amount of paint and nails used is not required on billing repair cards, as shown in Supplement No. 1.

Rule 9

Wheels and Axles R & R—When car is stenciled for type of wheels Standard to car, this information must be shown on billing repair card regardless of kind of wheels removed and applied. This procedure will protect car owner against incorrect charges and credits in case of improper substitution of wheels.

Journal Boxes—The words "friction bearings" added to indicate requirement with respect to periodic repacking, etc., applies only to boxes with friction bearings.

Journal Roller Bearing Units—New item added to provide information on billing repair cards covering periodic lubrication of journal roller bearing units in accordance with New Rule 66-A.

Journal Box Lids—Modified to include the new "A.A.R.-1947" approved type lids. When these lids are applied to a foreign car, repair card must show, in addition to Rule 101 item number and size, the type designation to justify the charge. These lids are marked "A.A.R.-1947" and Type Designation cast or stamped on lid, and the lids approved to-date are shown in Rule 101, Page 211.

Hand Brake, Geared R&R or R—New item added covering information required on billing repair card where geared hand brakes are R&R or R. When approved type gear is applied billing repair card must show, in addition to make or name, type designation drawing number per Rule 101 and "A.A.R.-1942" if so stamped or cast on housing. List of A.A.R. approved types of geared hand brakes is shown in Rule 101, Page 211.

Draft Gears—The word "Friction" eliminated because of the Waughmat Twin Cushion type draft gear, which is not a friction type gear, being conditionally approved for application to cars in interchange.

Rule 17

Sec. (c) Par. (7)—New added to permit substitution of A.A.R. Standard and A.A.R. alternate Standard (swivel type) coupler yokes of Grade B and high stencil steel as proper repairs. Charges and credits on basis of material applied and removed.

Sec. (e)—Brake beam substitution table revised by eliminating Item 1 and reference to non-A.A.R. and former A.A.R. No. 1 brake beams in Items 2, 4, 7 and 9, account these beams now obsolete.

Sec. (i) Par. (1)—Modified to permit substitution of A.A.R. approved friction draft gears for the Waughmat Twin Cushion gears (non-friction), providing they are interchangeable as to sill spacing and coupler pocket limits.

Sec. (i) Par. (6)—Modified to permit substitution of A.A.R. approved friction draft gears, with A.A.R. or alternate Standard cast-steel yoke, for defective Waughmat Twin Cushion gears and yokes as proper repairs. However the gear removed, whether or not defective, and the yoke if not defective, must be held for disposition of car owner. If owner does not request return, gear and yoke shall be credited on the basis of scrap value. New note added following Par. (6) prohibiting the substitution of Waughmat Twin Cushion gears for friction type gears.

Sec. (s)—New Section added to require stencil showing length of travel of long travel springs on cars so equipped. Second paragraph prohibits the substitution of 2½, 3 1/16- and 3 11/16-in. long travel springs for each other. The 3 11/16-, 3¾- and 3 13/16-in. travel springs are interchangeable and may be substituted for each other. For improper substitution issue defect card for labor and material. List of springs and weights is shown in Rule 101, Page 209.

Interpretation (B-5)—Modified, as shown in Supplement No. 1, to provide for issuance of defect card in case of improper substitution of geared hand brakes.

Interpretation (B-6)—Modified, as shown in Supplement No. 1, to provide that all geared hand brakes, whether approved or non-approved types, must be reclaimed in accordance with specifications covering repairs and reclamation of geared hand brakes.

Interpretation (B-7)—Modified, as shown in Supplement No. 1, to clarify intent non-approved geared hand brakes, even though repaired and tested per

A.A.R. specifications, are to be classed as non-approved brakes and must not be marked "A.A.R.-1942".

Interpretation (C-2)—New note added with respect to substitution and disposition of Waughmat Twin Cushion draft gear yokes.

Interpretation (M-11)—Added to provide, as proper repairs, substitution of friction for roller bearing wheels, in cases where such substitution can be made. However material removed must be held and reported to car owner for disposition, and if not returned such material, except serviceable wheels, shall be credited at scrap value. The same disposition of parts removed shall be followed when repairs are made in kind, whether material applied is furnished by repairing line or car owner.

(To be continued)

A. W. S. Forum On Welding Practices

Freight-Car Welding (Continued)

Q.—I would like to have information as to why one shop will use nothing but a 6012 electrode, while in other shops they restrict it to a 6010, and in some shops to 6013.

A.—On our railroad we have about 100 different suppliers, and if we used every type of electrode that is manufactured we would need a store as long as Broad Street (Philadelphia) to keep them in. Also, we have to standardize on about three different brands in order to avoid confusion. Take one brand of 6010 as against another brand of 6010. I will admit that the core wire is the same, but the flux coating is a company secret. It requires approximately a difference of five or ten amperes to fuse the metal in properly for the two brands. If we gave an operator five pounds each of five different brands to make up 25 lb. we wouldn't get proper fusion.

I do not think that ten or fifteen amperes is worthy of consideration if a welding operator is properly qualified. First of all, if any operator is qualified, he knows when he has fusion, and it doesn't make a bit of difference whose manufacturer's electrode is used. My experience is that you only need two electrodes for your general carbon steel work, one for welding in the flat position and one for welding in all positions.

I want to qualify the last answer. Take a specific electrode and half a dozen qualified operators, and you will find five, ten and fifteen amperes variation on the same job. One operator can handle a little more current with facility than the other fellow can on a given job with a given electrode. As regards 6010 and 6012 electrodes, there is so little difference between them that you don't have to worry about that. If a job calls for a 6010, use the 6010. It doesn't make any difference what manufacturer it comes from, if it is a reliable manufacturer.

I think I have a more direct answer. In my particular case I am using a 6012 electrode on a welded freight car, and the reason I used the 6012 instead of 6010, 6015 or 6020 or 6030 was that the railroad company asked for 60,000 lb. per sq. in. minimum tensile strength which the 6012 rod gives me. A 6010 rod doesn't give me the production speed that I want, so I went to 6012. It gives me the tensile strength I want and the maximum production speed in any position, over a 6010. In our fabrication I imagine we have the same trouble as everyone else; it is not too tight. So the 6012 rod was the best solution in our particular case. I wouldn't use the 6010; it takes too long. I can't use the 6020 in all positions.

S. A. Greenberg, technical secretary, American Welding Society: The problem is neither as simple as some of us have stated it, nor as complex, but there is very definitely a reason and purpose for each classification of electrode. This is without regard to the brand name. Generally speaking, within any classification, you can interchange your brands. There will be a slight difference in characteristics. You may have to hold a shorter or longer arc, or other things like that, but a good operator should be able to adjust from one to the other. From one classification to the other, from 6010 to 11 to 12 to 13 to 15 or 16, there are definite differences. If there weren't we would have what everybody has been talking about, but which we never will have, probably—a universal electrode.

The 6010 has a purpose. It is known as the deep penetration type. The 6011 is pretty much the counterpart of the 6010, only we have a. c. now and use that. The 6012 is used, for example, very widely in the structural industry. They have a problem of fit-up. If you have a poor fit-up you are far better off using a 6012 than a 6010. In some of the lighter work if you use a 6010 you are going to get into trouble. It has deep penetration, it is harder to control, and if you don't control it properly you will burn through. The 6013, as it has been more recently developed, is particularly good for fillet welding in the vertical position. The 6020, if you weld downhand, will give a lot more speed. You can use more current, and get a smoother appearance.

These things are deliberately made that way. The coatings vary widely, and those variations are deliberate in every case. They are to give you characteristics. If you are welding and it doesn't matter how much it costs you, go ahead and take any electrode and you can make it work. But practically speaking, whether you are building a car or whether you are repairing it, the problem is one of economy.

You don't need to stock any large quantity but you should stock a variety of electrodes for a given purpose. Not only that, but you ought to have standards to say that if you are building or repairing this type of part of these types of materials to certain thicknesses, we want to use a 6010. Tell your operators that and set up a policy. You will find that you stock less electrodes and that you will get more consistent results than when the operator is free to grab any electrode he can find.

(To be continued)

ELECTRICAL SECTION

Steam-Electric Locomotives*

By C. A. Atwell† and C. E. Baston††

Chesapeake & Ohio 6,000-hp. coal-burning units use Diesel-electric traction motors with simple controls

THE electric transmission equipment required for a steam turbine-powered locomotive is similar in many respects to that used on Diesel-electric locomotives. The principal differences are in the main generator and the control equipment. These differences result from the dissimilar speed-torque characteristics of the Diesel engine and the steam-turbine. The steam-turbine has a shaft speed many times that of the Diesel, will not stall if moderately overloaded, and its horsepower is practically constant over its operating range of speed. A comparison of these fundamental characteristics is shown in Fig. 1 on the basis of percentages of full horsepower, torque, and speed. The important differences shown here are that the turbine torque rises rapidly as speed decreases and that its horsepower is much more constant from full speed to idling speed. These characteristics determine the way in which the generator must be controlled properly to utilize the power available. In the case of the Diesel-electric, considerable development of generator control devices has been necessary to prevent overloading or "speed pull down" of the engine. Such overloading is not only bad for engine life but any speed pull down means a proportional reduction in horsepower. The generator receiving power from a steam turbine does not need to be controlled to the same degree against speed pull down, since there is little loss of power as speed is reduced over the operating range, and because operation at reduced speed at full throttle is not harmful to the turbine.

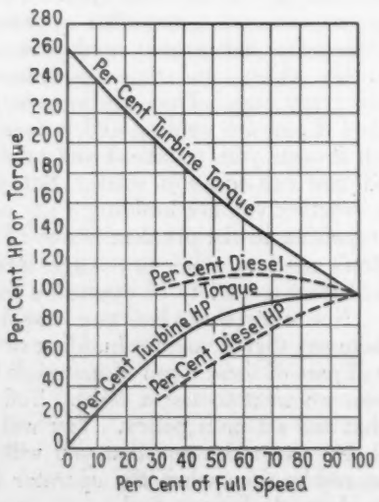


Fig. 1—Comparison of speed, horsepower and torque at full throttle—steam-turbine and Diesel engine

The type of service for which the C. & O. locomotives were built indicated a required net input of 6,000 hp. to generators for traction. This net input produces approximately 5,000 hp. at the rail. A turbine speed of 6,000 r.p.m. was chosen to give an economical and reliable turbine design.

Main Generators

The generator armature arrangement selected was determined by a combination of commutation,

* Paper presented at the winter general meeting of the American Institute of Electrical Engineers, New York, January 31-February 4, 1949.

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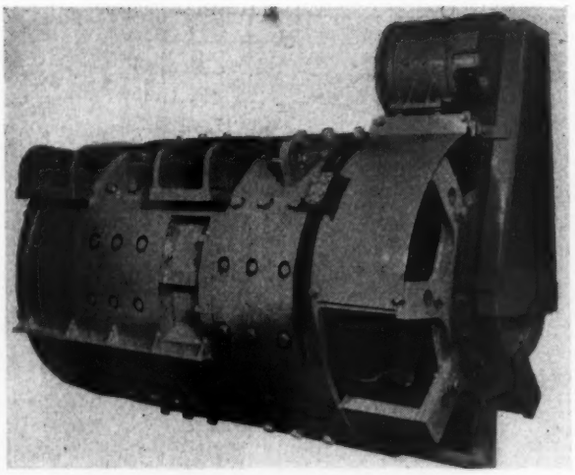


Fig. 2—One of the double armature generators with auxiliary generator

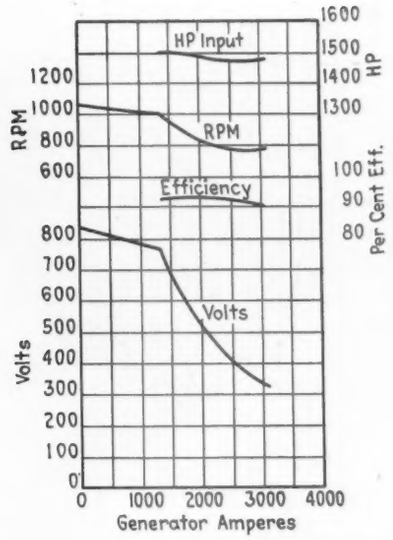


Fig. 3—Performance of one generator armature at full turbine throttle

mechanical, ventilation, and motor grouping requirements. Two double armature generators direct-connected to two gear wheels, driven by a turbine shaft pinion, proved to be an advantageous arrangement for meeting these requirements. The two generators are placed side by side in the locomotive and have a symmetrical mechanical relation to the turbine shaft. A 6-to-1 gear reduction gives the moderate speed of 1,000 r.p.m. for the armatures. With 1,500-hp. input to each armature at 1,000 r.p.m., good commutation and freedom from flashing are obtained without such special requirements as split-throw armature winding or pole-face compensating winding. Each of the four armatures supplies power to two traction motors in parallel. Four simplified independent power circuits are thus provided, any one of which may be temporarily removed from service without affecting the operation of the others.

The two multiple-wound armatures of the double-armature generator are duplicates and are pressed onto a common shaft with the commutators at the ends. A heavy duty self-aligning roller bearing supports the outboard end of this shaft and a flange at the drive end is bolted solidly to the turbine gear flange.

Each armature has its own field structure including eight main and eight commutating poles and coils. The armature punching coil and commutator construction is the same as that used extensively on Diesel-electric locomotive generators. The field construction is different from the usual Diesel-electric generator in that a large part of the main field is self-excited and that an auxiliary separately excited field is provided for external control. Also, no engine starting series field winding is required. The eight brush holders are mounted on an adjustable ring and are of the double brush type with brushes inclined to the commutator surface. Each brush holder is supported by two sturdy insulated pins and can be adjusted easily in a radial direction.

The double armature arrangement is also advantageous for generator ventilation. The air for forced ventilation of the two generators is supplied from a turbine-driven blower to a duct which leads to the bottom center of each generator frame. From here, the air divides and flows in opposite directions between field coils and through longitudinal ducts in th armatures, past the brush holders and commutators and out through the openings in the end housings. In addition to this, smaller ducts are led from the supply duct underneath the generator frame and directed so they provide a blast of unheated air directly on the lower side of each commutator.

The generator frames are made of exceptionally rigid construction so that they act as stiffening members in the power plant assembly. This frame stiffness, together with a solid vertical mounting plate between the generators, allows a relatively light substructure for the power plant as a whole, yet provides an assembly that is sufficiently rigid to keep all rotating parts in accurate alignment. The entire power plant unit is supported at three points; two trunnions at the turbine end, and a rubber supporting pad under the generator mount-

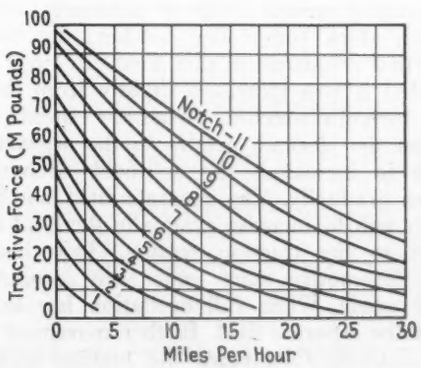


Fig. 4—Locomotive performance at reduced turbine speed, showing starting notches

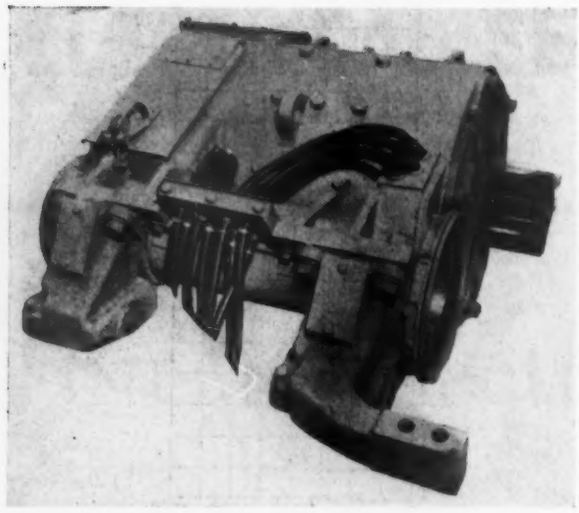


Fig. 5—Traction Motor

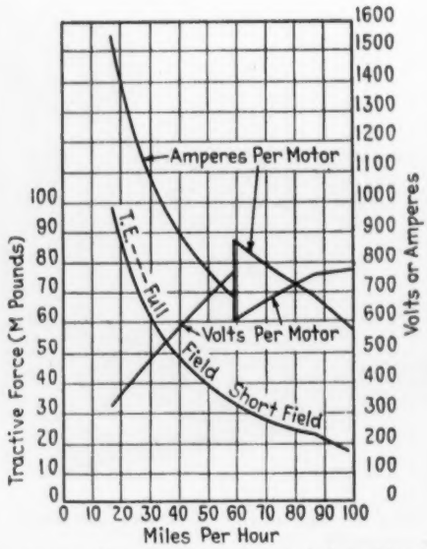

Amperes Per Motor
Volts Per Motor
T.E.---Full Field
Short Field
Tractive Force (M Pounds)
Volts or Amperes
Miles Per Hour
0 10 20 30 40 50 60 70 80 90 100
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600

Fig. 6—Locomotive performance at full turbine throttle —6,000 hp. input to generators—8 traction motors— 24:55 gear ratio—40-in. wheels

ing plate. This arrangement insures that stresses set up in the locomotive frame are not transmitted to the power plant assembly to disturb its alignments. A complete double armature generator (Fig. 2) weighs 25,800 lb. or 8.6 lb. per hp. input.

Generator Performance

Each of the four armatures is rated continuously at 560 volts, 1,860 amp., at 1,000 r.p.m.

Fig. 3 shows the voltage and speed regulation, efficiency, and horsepower input to one generator armature when operating at full throttle. This performance is obtained with the self-excited and separately-excited fields set with minimum external resistance. As mentioned before, the pull down of speed at heavy ampere loads is of little consequence, since the horsepower decreases but little with speed and operation at reduced speed is not harmful to the turbine. For example, at 75 per cent of full speed, the horsepower is still 96 per cent of that at full speed. Actually, very little operating is done at full throttle at ampere loads greater than the continuous ampere rating of 1,860.

When the locomotive is ready to start, the turbine is idling at 63 per cent speed (3,780 r.p.m.) and the generators are running at 630 r.p.m. The strength of the separately-excited fields is gradually increased in eleven steps (controller notches) by reducing the external resistance in that field circuit. The turbine speed is also increased slightly from the sixth to the eleventh notches. Generator speed is 750 r.p.m. on the eleventh notch. As the separate field strength is increased, the self-field strength also increases gradually. The separate field notches are small enough to increase gradually the load current supplied to the traction motors. This insures a smooth locomotive start under any condition of load or grade. When full excitation has been applied to the separate field, further movement of the master controller increases the turbine speed further. The self-excited field obtains its supply from the generator terminals through an adjustable resistance. This resistance is automatically controlled in two steps. The first step limits uncontrolled build up and the second permits full voltage at higher speeds.

Auxiliary Generator-Exciter

Each main generator has a V-belt-driven 9-kw., 75-volt, 120-amp., self-ventilated auxiliary generator, regulated to give constant voltage from 2,250 to 1,350 r.p.m. A maximum of 3 kw. is required for the separately excited fields of the main generators. These auxiliary generators also supply low voltage power for meter and indicator lights, control and other auxiliaries such as the mechanical lubricator pump and the air brake system. Either of the two auxiliary generators can supply all of the locomotive low voltage requirements. Two were installed, however, so that normally they are operating well below their rating. This also made the construction of the right and left hand main generators duplicate at this end. A single regulator controls both auxiliary generators in parallel. Either may be cut out without affecting the operation of the locomotive. Each auxiliary generator weighs 570 lb.

Traction Motors

The eight main driving motors are the Westinghouse type 370-F direct-current motors which are widely used on large Diesel-electric locomotives. This motor rates 560 volts, 930 amp., 750 r.p.m. continuously with full field. This motor is six-pole, series-wound, force-ventilated, axle-hung, and is geared to its driving axle with single reduction spur gearing of proven design. The entire motor is constructed for high-speed, heavy-duty railway service, and its many successful applications have proven its reliability on both freight and passenger locomotives.

The electrical control of a steam-turbine-electric locomotive bears some resemblance to that of a

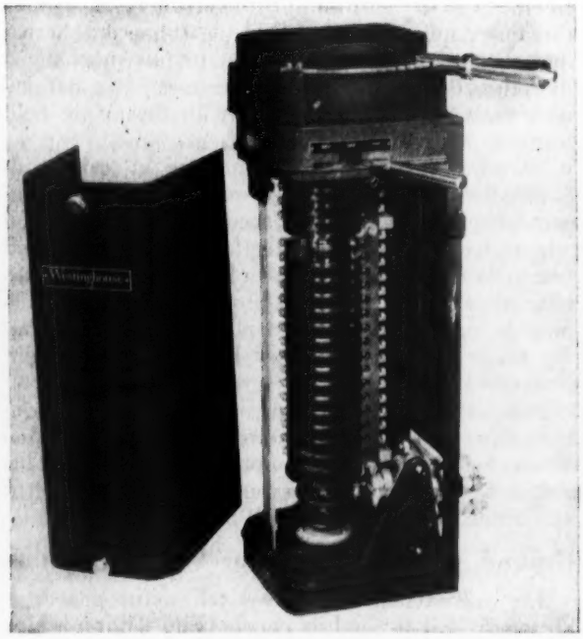


Fig. 7—Master controller used on steam turbine-electric locomotive

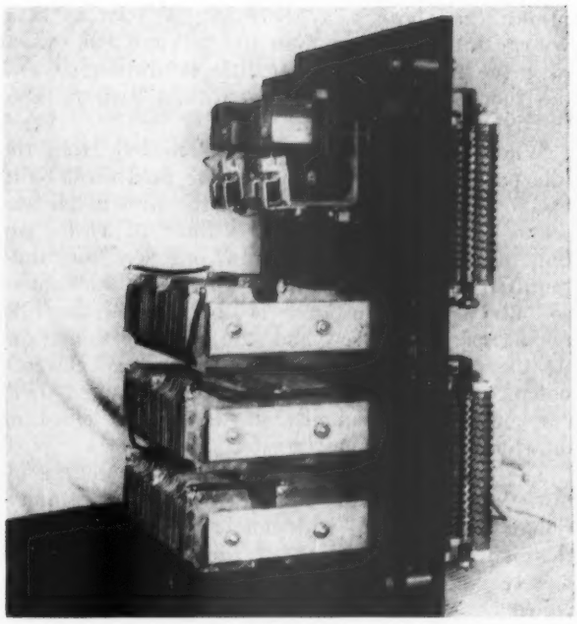


Fig. 8—Control panel for self-excited fields of main generators

Diesel-electric locomotive. The differences arise from the different characteristics of the prime mover which has been described in detail above. The idling speed, being approximately 60 per cent of full speed, makes it necessary to apply field excitation to the main generators gradually. Thus, the master controller, (Fig. 7), has two functions. One portion controls the contractors varying the resistance in the separately excited fields of the main generators and the second portion controls the speed setting of the turbine governor. The field contactors are controlled by a series of contact units operated by cams on the master controller shaft. A cam on this same shaft varies the setting of an air pressure regulator which is connected by means of a control pipe to a spring-loaded operating cylinder which is connected by a link to the governor actuating arm. Since no control battery is used on this locomotive, a second cam actuates an air valve which permits bringing the turbine up to the idling speed without control power being available.

An idle position is provided between the off and on positions of the master controller. Steam is admitted to the turbine on this notch and the motor switches are closed but no excitation is applied to the generators. A stop is provided on the master controller so that the handle is stopped in the idle position on a normal shut off. To move the handle to the off position and stop the turbine, a button in the end of the handle must be pressed.

The idling speed of the turbine is such as to cause the generators to build up as shunt excited machines with the normal field resistance in the circuit. To prevent this, a step of resistance is inserted which is above the critical value. This resistance is cut out of the circuit by means of contactors controlled by a voltage relay whose operating coil is connected across the generator

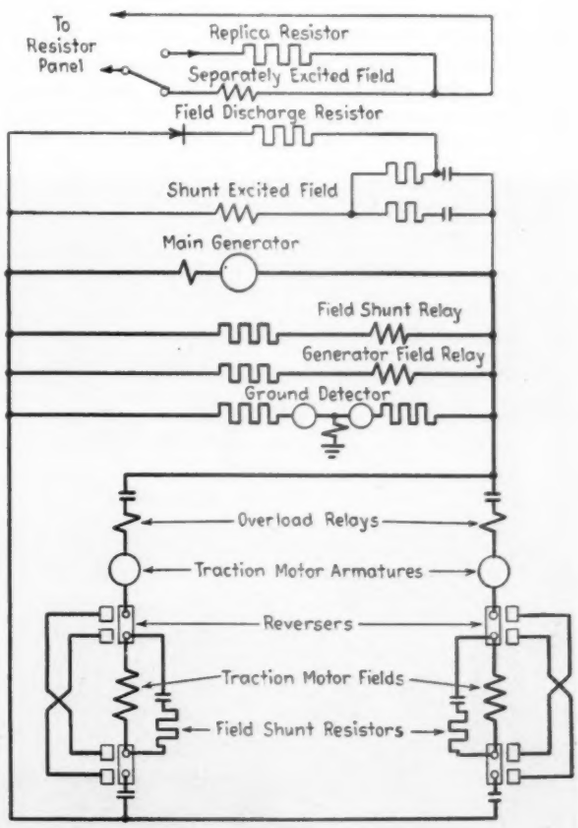


Fig. 9—Schematic wiring diagram of one of the four generator circuits

armatures. These relays are set to operate at a voltage somewhat less than the maximum at which time the fields are approaching saturation so that the increased field current does not give a large tractive force increment.

When the master controller is moved from the idle position to the first notch, the field must build up, so the value of the field on the first notch was set to give a moderate tractive force of 27 lb. per ton of locomotive weight. In practice, the time required for the field to build up softens the control so only a gentle response is obtained on the first notch, making for easy and safe coupling to a train. As the controller is advanced toward the eleventh notch, the increments of separately excited field current become gradually smaller as the effect of the shunt field becomes greater.

The net result is essentially uniform notching up to the eleventh notch. Beyond this point, the quadrant is not provided with notches. The reason for this is that this portion of the master controller merely changes the speed setting of the governor which can be done smoothly without notches. The turbine speed indicator serves as a guide to the engineman in manipulating the master controller.

Simplified Main Circuits

There is no interconnection between the four armature circuits. Each armature supplies two traction motors connected in parallel, thus the problems encountered in paralleling the generators were avoided, and in addition the cutting out of motors or generator armature is simplified. A small double-pole, double-throw knife switch opens the motor switches and the generator fields in each circuit, thus preventing operation of damaged equipment. In the cutout position of this switch, a replica resistor duplicating the field is connected across the excitation circuit. This maintains unchanged the other three fields that are connected in parallel with each other and in series with the single field resistor.

An adjustable resistor is connected in series with each separately excited field so as to permit compensating for slight differences in generator and motor characteristics. In practice, it has been found that only slight adjustment of these resistors has been necessary to balance the power equally on the four generators over practically the whole operating range and once set, they hold their adjustment permanently.

One step of field shunting is provided by a non-inductive resistance connected across the traction motor fields by an electro-pneumatic switch. This switch is controlled by a voltage relay connected across the generator armature.

Ground, Overload, and Wheel Slip Protection

The self-excited fields of each main generator are controlled through a panel, (Fig. 8), on which are mounted the resistors on the back and the contactors and a Rectox unit on the front. This Rectox unit permits field discharge current to flow through the resistor but prevents any current flow through the field discharge resistor under normal conditions. A relatively low value of discharge resistance may thus be used to provide ample protection from inductive kick when the field current is suddenly decreased or the circuit opened.

Overload protection of the electric equipment is accomplished by relays that are arranged to de-energize the emergency trip valve thus shutting down the turbine without interrupting the load.

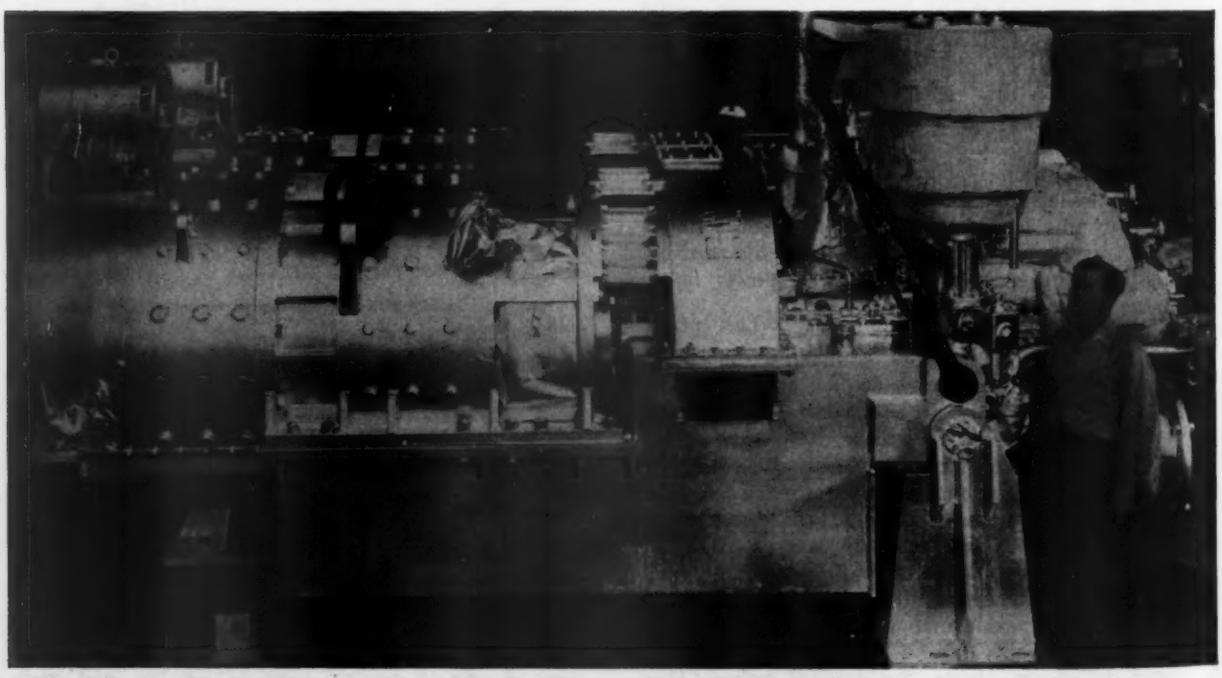


Fig. 10—Side view showing mounting trunnions and foot of power plant assembly

The parallel connection of the traction motors minimizes the effect of wheel slippage, but a slip relay is provided, connected between the two traction motors which are connected to the same generator armature. The relay coil connection is made at the junction of the field and armature leads in each motor circuit. As long as the counter electromotive force, and consequently the speed of the two motors is equal, no current passes through the relay. If a wheel slips, the counter electromotive force of its motor increases, and a current passes through the relay coil causing it to close its contacts and causes a warning buzzer to sound. It does not shut off or reduce power.

The main and control circuits are not solidly grounded but a simple ground detector is installed which provides a phantom ground midway between the positive and negative busses. This reduces the voltage strain and provides an indication but does not cause a locomotive failure when an accidental ground occurs. This permits the fault to be located and repaired before a second ground could occur and disable the locomotive.

From the diagram, (Fig. 9), which shows the main circuit of a single armature, the simplicity of which is readily apparent, it can be seen that the circuits involve a minimum of apparatus, the connections of which can be readily understood by the maintenance forces.

The electrical equipment for these locomotives employs generators, motors, and control that were designed and built on well-known and proven electrical and mechanical principles. That these principles have been combined in a way especially suited to a steam turbine-powered locomotive of high horsepower is shown by the successful performance of this equipment in service.

Progress with Silicones*

Since the middle of the year 1944, when silicone varnishes were first made available commercially, thousands of electric windings have been treated with, or contain, silicone in their component parts.

The successful performance of these windings has resulted in broadening their scope, so that today we have many forms of silicones. There are thermoplastic and thermosetting varnishes, stickers, pigmented varnishes, glues, greases, rubbers, sealing compounds, and miscellaneous fluids.

One of the more important characteristics of all the various kinds of silicones is that when overheated they do not carbonize. When decomposition does occur, it is at a temperature far in excess of the carbonizing temperatures of organic materials, and the residue is a white silica base powder.

* From "Coil Talk"—National Electric Coil Company, Columbus, Ohio.

The two most popular silicone insulating varnishes are still DC 993, baking at 500 deg. F., and DC 996, baking at 300 deg. F. There has been little change in the properties of these varnishes, though some improvements have been made to provide somewhat shorter baking time and to produce a tougher film.

The major advances in silicone-treated windings have been in technique of silicone application. One of the arts necessary for the successful application of these varnishes is to arrive at the proper baking time. This baking time varies between batches of silicone varnish, so each new lot must be evaluated.

The varnishes must be thinned to the proper viscosity by using a viscosemeter and not by hydrometer.

Most users are confining their silicone varnish treatments to the DC 996, which can be cured with less difficulty than the DC 993. DC 996 varnish offers ample temperature range, with long life for normal high temperature industrial motor and generator applications.

Other silicone preparations currently being used in coil manufacture and armature winding are DC 804, clear bonding varnish for field coils, XR 100, clear bonding varnish for glass laminates and for mica laminates, and X 930, silastic compound for filling voids in coils and windings. These products will withstand about the same temperatures as DC 996 and like all silicones will not carbonize when overheated.

A.I.E.E. Class H Insulation

The need for a new insulation classification has arisen through the wide acceptance of silicone products in both new and rebuilt electrical equipment.

A tentative standard was introduced by the A.I.E.E. for one year trial use, which defines in Table No. 1, Class H insulation as follows:

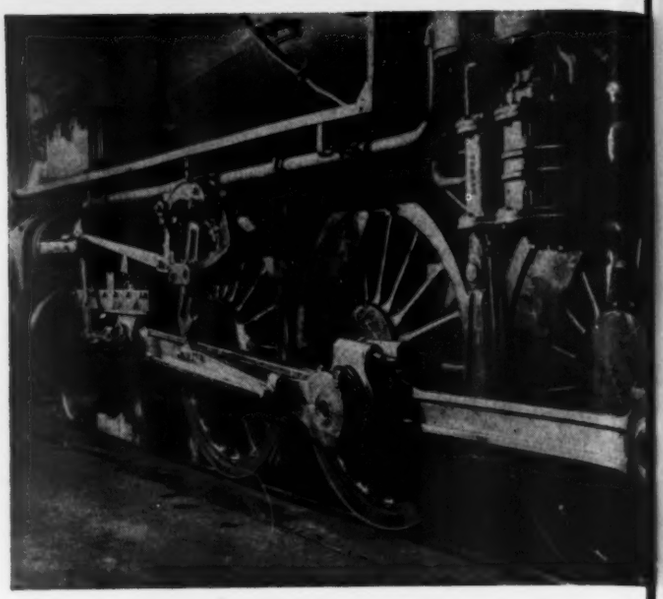
"Class H insulation consists of (1) mica, asbestos, fiberglas and similar inorganic materials in built-up form from binding substances composed of silicone compounds, or materials with equivalent properties; (2) silicone compounds in rubbery or resinous forms, or materials with equivalent properties. A minute proportion of Class A materials may be had only where essential for structural purposes during manufacture."

A footnote reads as follows: "The electrical and mechanical properties of the insulated winding must not be impaired by the application of the temperature permitted for Class H material, (the word 'impaired' is here used in the sense of causing any change which could disqualify the insulating material for continuous service)."

The temperature standards give the value of the "hottest-spot" temperatures for the various A.I.E.E. insulation material classes as follows:

For Class O material—90 deg. C. (194 deg. F.)
For Class A material—105 deg. C. (221 deg. F.)
For Class B material—130 deg. C (226 deg. F.)
For Class H material—180 deg. C. (356 deg. F.)
For Class C material—no limit set.

CONSULTING DEPARTMENT



Can you answer the following question? Answers should be addressed: Electrical Editor, Railway Mechanical Engineer, 30 Church Street, New York 7.

To what extent are solderless terminals and connectors suitable for railroad application?

Lighting System Maintenance

Good lighting depends upon a good installation that is adequately maintained. Can you suggest some way of encouraging railroad users to keep their lighting systems in good condition?

Good Lighting Is Inexpensive–If

Without question a good lighting system represents a good investment just as any other tool. The word, tool, is used because that is exactly the classification to cover a good lighting system. Railroad shops, it is granted, represent "dirty work" due to the combination of oil, grease, smoke, soot, steam and weather. Yet lighting is necessary and good lighting is required if good work is to be turned out efficiently.

In terms of benefits derived, a good lighting system is inexpensive but if it is not well maintained it becomes a very costly tool. Naturally, cleaning and maintaining a lighting system involves some expense, but this cost does not begin to approach that of a lighting system that has been installed, and not used or maintained in top condition.

The problem involving maintenance of railroad lighting systems in railroad shops, for instance, should be the responsibility of the shop foreman or superintendent.

The worn out excuse that shortage of labor or expense of labor involved prohibits cleaning and relamping lighting equipment is out of order. One might just as well use the same argument in the case of repairing or maintaining machine tools, heating systems, water systems or a hundred or more items used in railroad shops, and which are necessary for their operation. It must be remembered that the work turned out by an employee cannot be expected to be any better than the tools which he uses to do the work.

It is amazing that foremen, superintendents and the shop workers themselves are continually demanding better lighting conditions and then when their requests are finally granted, they appear to want no part in helping to take care of it, and keep it in efficient working condition. Possibly this matter will require that operating officials responsible for making the necessary funds available for the purchase of modern lighting systems, will exercise interest beyond this point. No employee should have his request for good lighting granted if he cannot be relied upon to keep it in good operating condition. It is at this point where the shop foreman or superintendent becomes directly responsible and account-

The cost of lighting can be tied in quite closely with the cost of maintaining a lighting system.

Using as a typical lighting fixture equipped with 100-watt fluorescent lamps, the following analysis results in some very surprising results.

Installation cost and fixture	$30.00
Annual owning cost at 20 per cent per year	6.00
Cost of 4 lamps per year (6,000 hr. operation 30 per cent discount	6.44
Annual power cost at 1 cent per kw.-hr.	13.92
Annual operating cost	$26.36

The total operating cost amount to $26.36 represents a charge that is incurred regardless of whether or not the lighting fixture is providing light in an efficient manner. The cost of cleaning must be added to this figure to arrive at the total lighting expense. This cleaning cost is subject to several variables such as local labor costs, type of fixture, as well as physical difficulties encountered in carrying out the task.

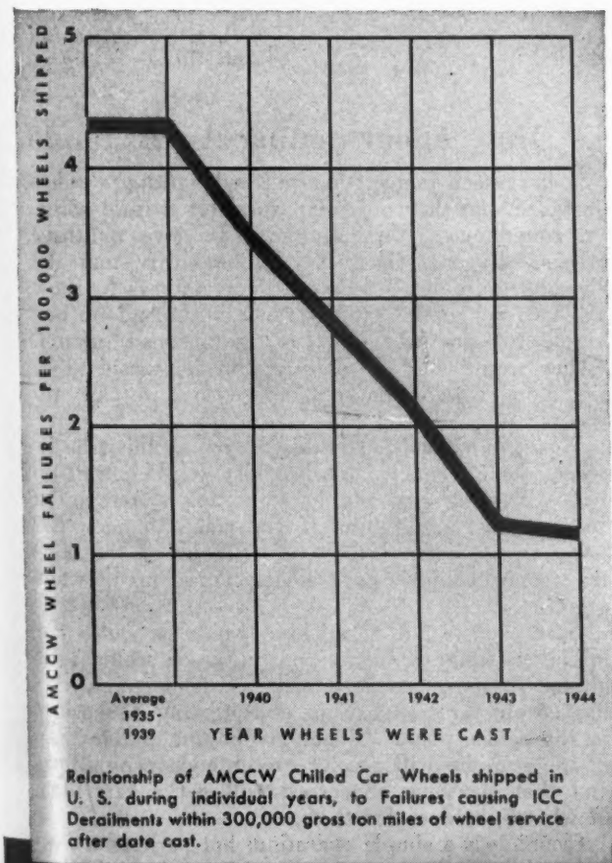
A typical problem can be worked out as follows:

Cost of labor in removing, cleaning and replacing reflector and lamps		$ .75
Cost of 12 cleansings per year at $.75		9.00
Annual cleaning cost	$ 9.75	
Annual operating cost (exclusive of cleaning)	26.36	
Total Annual Cost	$36.11	

From the above, one can quite logically compare a good lighting installation with an investment; an

Chilled Car Wheels

SURPASS OWN SAFETY RECORD



Relationship of AMCCW Chilled Car Wheels shipped in U. S. during individual years, to Failures causing ICC Derailments within 300,000 gross ton miles of wheel service after date cast.

The descending curve in this recent chart marks a year-by-year reduction in AMCCW wheel failures. It compares relative failures during equal service periods.

It shows that the *trend to greater safety continues.* Chilled Car Wheels cast in 1944 surpass their own previous record. They had fewer failures —during their first 300,000 gross ton miles— than those cast in any other year.

Behind this improvement in safety are (a) higher standards of wheel making carried out by members working closely with AMCCW Resident Inspectors and General Inspectors, and (b) the results of uninterrupted research and tests made increasingly strict by AMCCW metallurgists in the Association's laboratories.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

445 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.

American Car & Foundry Co. • Canadian Car & Foundry Co. • Griffin Wheel Co.
Marshall Car Wheel & Foundry Co. • New York Car Wheel Co. • Pullman-Standard Car Mfg. Co.
Southern Wheel (American Brake Shoe Co.)

investment that must be protected with dollars spent for cleaning if any dividends are to be expected. Without this care or protection, the lighting soon fails to do the work for which it was installed. In the case of the example shown, without cleaning, the lamp will amost entirely cease to produce light, and its annual cost will remain $26.36. It then becomes a liability instead of an asset.

H. H. HELMBRIGHT
General Electric Lamp Department,

What About Existing Equipment?

Nature provides 500 to 10,000 footcandles of well distributed, good quality light for daytime work. Under these conditions certain high standards of speed and safety in working become established for any activity. Artificial lighting of large areas at comparable levels is beyond reasonable possibility. Maintenance of daytime speed and activity during the hours of darkness is, therefore, possible only by using relatively little light, properly directed according to scientific principles and experience. If, through the effects of service conditions, a large proportion of this relatively small amount of light is lost, the difficulty of quick and accurate seeing becomes great. It follows, therefore, that wherever normal service conditions are severe, systematic and thorough maintenance of lighting equipment is essential to efficient, economical lighting.

Conditions which reduce lighting effectiveness are as follows:

1. Dampness, salt fog, or acid fumes from coal smoke may cause decomposition of metal parts.
2. Vibration from wind and traffic may throw floodlights out of adjustment and possibly cause short lamp life.
3. Dust and grime on reflectors and door glasses may absorb 50 per cent or more of the useful light.
4. Inefficient lamp operation resulting from low voltage or undersized or badly blackened lamps greatly reduces light generated.
5. High internal temperatures may destroy rubber insulation and gaskets, and sometimes the silvering on glass reflectors.

In recognition of the presence of all of these conditions, the equipment selected for railroad lighting is usually the best type obtainable. Normally, the amount of maintenance attention required is small. However, the lack of it may have reduced to an unusual extent the efficiency of existing lighting equipment. For this reason, such equipment should be carefully inspected periodically.

The following are suggestions for restoring existing equipment:

1. Thorough inspection of all lighting units is recommended. Metal parts that are still satisfactory mechanically should require at least cleaning and painting with a durable weather-resisting paint. Glass surfaces can be washed with any mild non-abrasive cleaning compound. Porcelain enameled reflectors can be washed in a similar manner. If the reflectors do not respond to cleaning methods but are not badly chipped or rusted, they probably can be re-enameled. Reflectors in bad condition should be replaced. Glass reflectors with deteriorated silvering sometimes can be resilvered, or the manufacturer may offer an exchange proposition. Dried-out and cracked rubber gaskets and insulation should be replaced.
2. Check position, aiming, and lamp size with the original lighting plan if available. Check voltage at the lamp socket with full load burning, to see that other loads added to the feeders have not caused inefficiency from low voltage operation.
3. If physical changes have altered the illumination requirements, the services of a lighting expert familiar with new equipment and advances in lighting technique can be obtained.

A properly designed lighting system, if properly maintained, will keep railroad yards operating at maximum efficiency while providing a minimum amount of risk for railroad employees. Keep 'em rolling.

R. J. SWACKHAMER
General Electric Company.

How About Setting An Example

I have seen many good railroad lighting systems installed, but they only stay good for a little while. In roundhouses, they are good for two or three weeks. By that time, they are so dirty that the lighting units are little more than markers to show the location of the runways and pits. And no one seems to care whether they are cleaned or not. "They would only get dirty again, and besides, we got along with oil torches before, and we can still do it."

Now, my suggestion is this. How would it be if, when some capable, hardworking and optimistic young lighting man put in a lighting system on a railroad, he would himself undertake to keep ten per cent of the fixtures clean? Wouldn't the contrast soon make everyone acutely conscious of what cleaning does?

Sure, he would be sticking his neck out. He might be assigned the responsibility of seeing that all the fixtures were kept clean. Or, he might get bawled out for wasting time and creating dissension in the ranks. But, I'll bet my bottom dollar that in the end, he will receive credit and recognition, and that everyone concerned will get a fair idea of what light does for them.

Cleaning is a simple operation, but perhaps a few suggestions and precautions are in order. Under average dirt conditions, cleaning every three or four months may be enough. In some enginehouses, the months might be reduced to weeks or days. If you have a footcandle meter, or a photographic exposure meter, it will help a lot in determining the time to clean. Generally speaking, when the light output

there is a place

WE FIRMLY BELIEVE that for a long, long time, there will continue to be a demand for steam locomotives.

Therefore, while we *are* building diesel-electrics for the switching field — and while we have nearly completed experimental work on the free-piston gas generator for locomotive use — we will continue to build a complete line of steam locomotives.

We will continue to explore all possible ways of improving such locomotives. We will continue to build them with the traditional fineness of design and manufacture that is responsible for Lima's world-wide reputation. And we will continue to believe that there is a place for these locomotives — for such modern power as the 2-8-4's we are now building, as our fifth order for the Nickel Plate.

LIMA HAMILTON CORPORATION

DIVISIONS: *Lima, Ohio*—Lima Locomotive Works Division; Lima Shovel and Crane Division. *Hamilton, Ohio*—Hooven, Owens, Rentschler Co.; Niles Tool Works Co. *Middletown, Ohio* — The United Welding Co.

PRINCIPAL PRODUCTS: Locomotives; Cranes and shovels; Niles heavy machine tools; Hamilton diesel and steam engines; Hamilton heavy metal stamping presses; Hamilton-Kruse automatic can-making machinery; Special heavy machinery; Heavy iron castings; Weldments.

from a clean fixture has dropped from 15 to 20 per cent is a good time.

Just dry-wiping the fixtures is not enough. It does not do a good job and may scratch the surface of the reflectors. Tests show that washing will reclaim 10 to 15 per cent more light.

If it is possible to take the fixtures down, they can be scrubbed with a soft brush or sponge in the cleaning solution and rinsed in warm water. Care should be taken not to immerse the lamp bases. When the unit cannot be taken down, it should be cleaned with a cleaning compound which removes dirt quickly and thoroughly and requires no rinsing. After such cleaning, the excess moisture should be wiped off with a clean cloth.

One precaution to be observed is to avoid strong alkaline agents or acid when cleaning aluminum reflectors. A thin film of liquid wax applied to a clean reflector surface will quite effectively protect the surface, and will serve to reduce the number of cleanings required.

ELECTRICIAN.

Why Buy It and Throw It Away?

Would a railroad operator send out on the road a leaky tender which would lose half of its water before it got to its destination?

Would he send out a locomotive so badly scaled that only half the heat could get to the boiler water?

Would he send out on the road a Diesel with a leaky fuel tank so that half the oil would be lost en route?

He would NOT! It would be an expensive waste of water, coal and oil. It would slow his schedules and decrease his pay loads, per power unit. All this is avoided by proper maintenance.

Why, then, should he pay for the generation of light and allow half or more of it to be absorbed uselessly by dirt on his lighting fixtures? This, too, slows his operation by decreasing the rapid and accurate perception of work to be done by his employees. The continuous strain of seeing under difficult conditions tires his workers, unduly, retarding their activities and inducing errors and spoilage. Poor light is depressing and destructive to morale. These conditions, too, are wasteful. They may and should be corrected by proper maintenance of lighting facilities.

ENGINEER

Effect of Commutator Condition on Brushes

What effect does commutator condition have on brush performance?

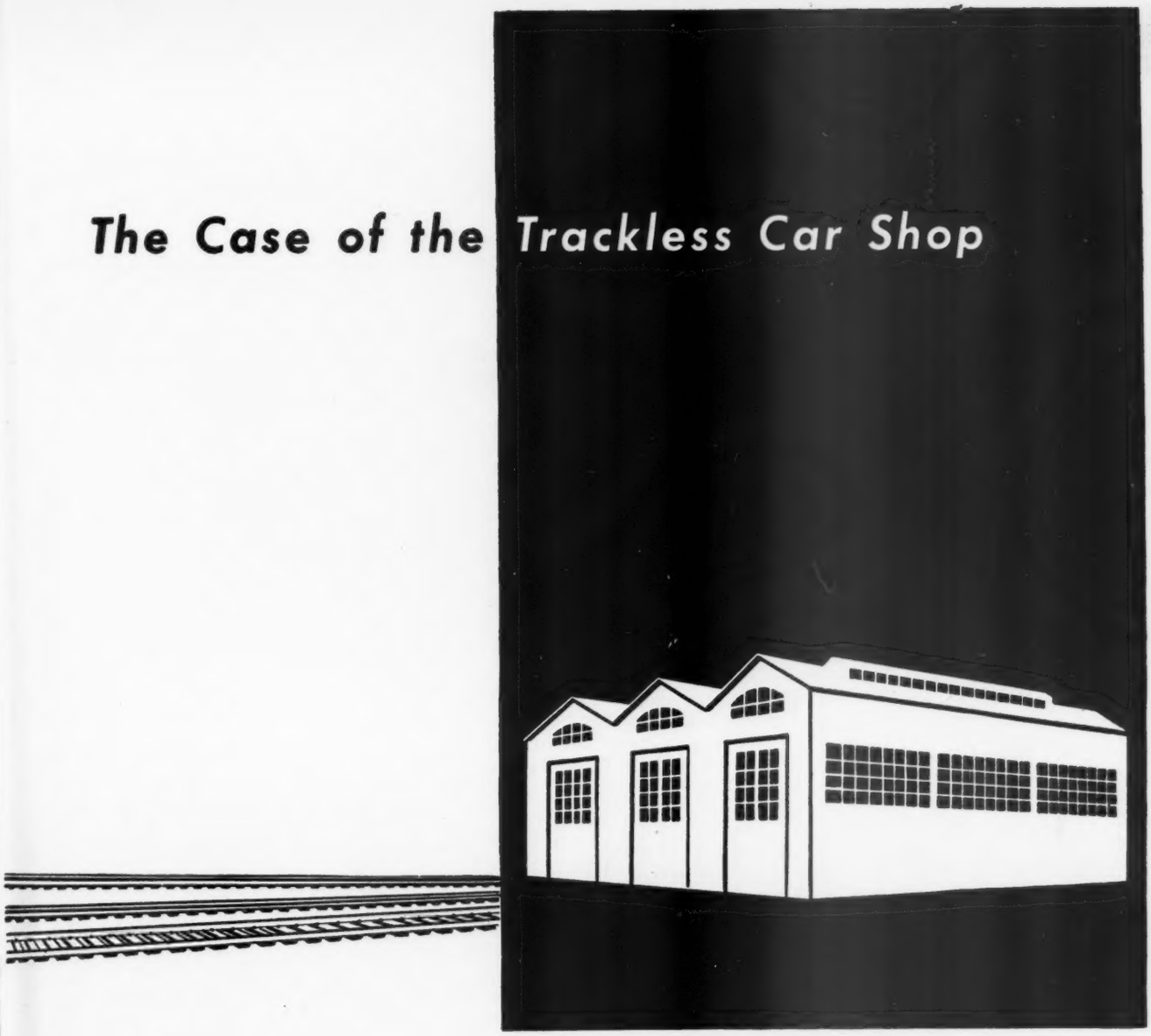
Poor Surfaces Get Progressively Worse

If the commutator condition is bad, the contact resistance between the commutator and brush surface is increased. This increase in resistance causes minute sparking under the brush, and also increases the brush heating and brush resistance losses. This increase in resistance is not uniform between brush and brush, and between different sets of brushes. This upsets the current distribution in the armature. The brush performance is affected by this increase in resistance and the heating. In severe cases, this may cause the face of the brush to become red hot, and the whole brush to become too hot to touch. This heat is conducted to the brush pigtails, the springs and the brush holder. This causes expansion and other troubles, and may cause brushes to stick in their holders. Brush springs often become weak through this cause. Heated brushes cause a heated commutator causing severe wear on both. Severe sparking will be caused, and if allowed to continue, flashovers will occur all around the commutator and between different sets of brushes.

W. E. Warner.

A 70-ton American Locomotive-General Electric Diesel-electric switching locomotive passing through an old wooden-covered bridge on the St. Johnsbury & Lamoille County—The St. J. & L. C. has almost completed Dieselization with the acquisition of four Alco-G.E. 70-tonners—One more is scheduled for shipment in the near future

The Case of the Trackless Car Shop



It's *trackless* and *safe*, thanks to Wyandotte Zorball, the all-purpose floor absorbent.

Zorball absorbs oils, water, paints and other liquids quickly and completely. It provides an immediate anti-skid surface to soiled floors, thereby reducing the danger of slipping accidents. And because it does not readily cling to shoes, it is not tracked from one part of the shop to another.

Zorball is chemically inert and non-flammable. It furnishes lasting protection against fires resulting from the accumulation of combustible materials on floors.

You'll find it especially valuable in the car shop, roundhouse, machine shop and storerooms.

Your Wyandotte Representative will be glad to demonstrate the effectiveness and economy of Wyandotte Zorball at your convenience. All you have to do is give him a call.

Trouble afoot? Why not try **WYANDOTTE ZORBALL**

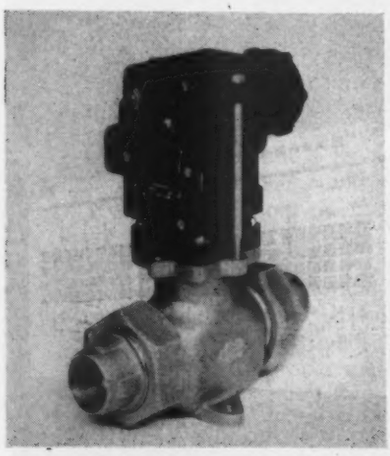
WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES

Wyandotte
REG. U. S. PAT. OFF.

NEW DEVICES

Motorized Steam Valve

A motorized steam or Freon valve which can be used for either modulating or on-off needs in transportation equipment has been developed by the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. It includes vee ports in sizes to handle quantities of 38, 55 and 95-lb. of steam per hour at 5-lb. pressure and a reversing and positioning



motor, and is designed to decrease the possibility of sticking.

In event of electrical failure, the valve will remain in balanced position because it does not include a spring return. The device can be operated by motors drawing power from 32, 64 and 115-volt d.c. and 115-volt, 60 cycle a.c. circuits. It also includes union connections for one-inch iron pipe size.

Carbide Tool Grinder

A carbide tool grinder that can be used either wet or dry is available from the Hammond Machinery Builders, Inc., Kalamazoo, Mich. Known as the model WD 10, wet operation is attained by turning a baffle plate and the exhaust outlet to off position, and switching on the coolant system. For dry operation the coolant is turned off and the baffle plate and exhaust outlet opened.

The grinder has two tables 10 in. by 19 in. equipped with a removable steel wear plate. The table slot, in which the compound protractor tool gauge slides, has openings to allow for coolant drainage. The tables are adjusted to any angle from 15 deg. above to 30 deg. below horizontal.

A safety cup disc completely fills the open cup of the wheel to prevent injuries or dropping of tools into the cup of the

wheels. Patented "No Spray—No Splash" guards are said to permit unrestricted vision but to keep the operator and floor dry. Modifications of this grinder include a model with one cup and one straight wheel, and two models for dry grinding only.

Vacuum Impregnators

The F. J. Stokes Machine Co., 5900 Tabor road, Philadelphia, Pa., has announced a complete line of Stokes equipment for the vacuum impregnation of the generator and traction motor armatures of Diesel-electric locomotives. The maker states that through the use of these units, trapped air and moisture in the windings and slots, which result in insulation breakdown and mechanical failures, are eliminated.

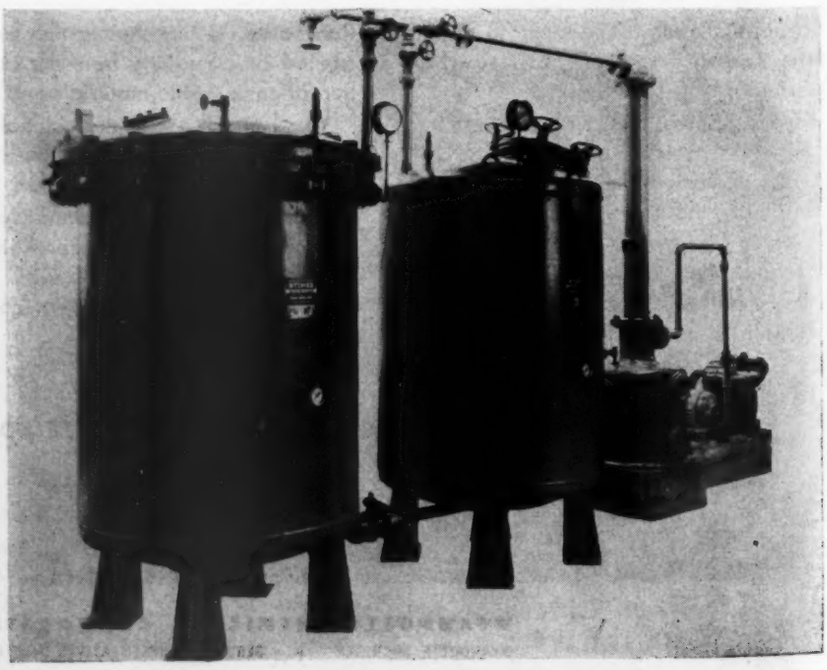
The impregnator is a complete packaged unit to handle any size or type of armature. Included in the installation are: an impregnating tank for high vacuum or 100 lb. per sq. in. gauge pressure in the interior; impregnant storage tank for high vacuum or atmospheric pressure; plug-type valves interconnecting the two tanks; a vertical vacuum-type surface condenser; a rotary oil-seal high vacuum pump; and dial-type vacuum and pressure gauges, thermometers, vacuum recording instrument, and safety and blow-off valves.

Other features include a hydraulically operated quick-opening cover on the impregnating tank inert gas pressure system and clear-view sight glasses with adjustable spotlights.

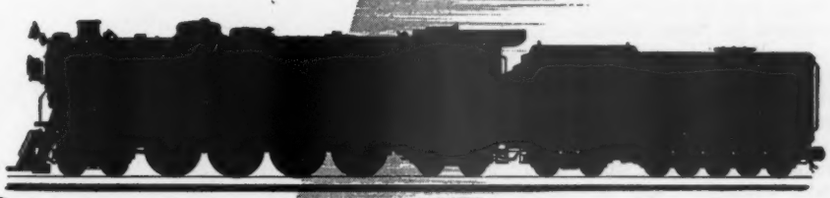
Sheet Metal Drawing Press

A drawing press of 1,000- or 500-ton pressure capacity and designed to handle deep draw jobs of large dimensions is a product of The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. It has a platen of 120-in. by 72-in. by 70-in. daylight opening and 36-in. ram travel and is equipped with a 300-ton die cushion with a platen of 48-in. by 52-in. and a 24-in. stroke.

The press is equipped with three main rams for the multiple press ram system of operation in two ranges of pressing speed. For a fast preliminary pressing



Don't make stepchildren of your steam locomotives



Surely it is important to protect your investment in your existing steam motive power. There are plenty of veteran steam locomotives which — merely with the modernization of certain features—can turn in a good profit on their operation for many years to come.

The installation of Security Circulators, for example, will definitely improve steaming performance and make possible much greater locomotive utilization — sufficient to rapidly repay the installation cost.

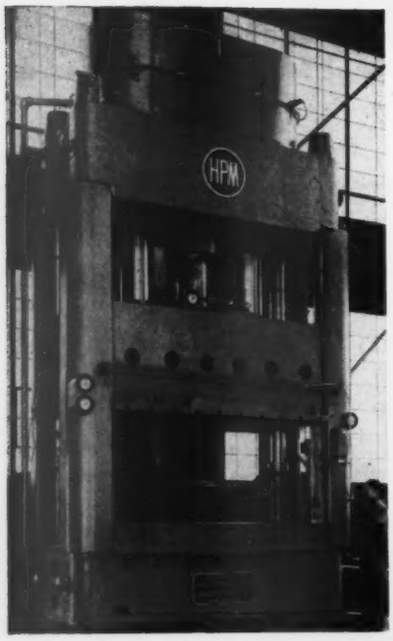
The many advantages resulting from the use of Security Circulators have been shown by the road experience of fifty railroads — with installations of Security Circulators in twenty-five different types of locomotives.

* * *

For oil-burning steam locomotives the American Arch Company recently developed and introduced the Security Dutch Oven. Its value in improving combustion has been recognized by a number of railroads, which have already installed Dutch Ovens in over two hundred locomotives.

American Arch Company Inc.

NEW YORK • CHICAGO



at medium pressure, either the central main ram or the two outer rams can be employed with a 500-ton pressure. At a predetermined position, all three rams can be used to develop the high pressure required for final forming.

The H-P-M Closed Circuit Fastraverse system of operation, which regulates both the speed and direction of every press ram movement through control of the output of the pressure-generating H-P-M radial pump is a feature. Operation is fully automatic and is controlled by electric push-buttons located at the operator's station.

Wainscoting Metal

A product known as Rigidized Metal and manufactured by the Rigidized Metals Corporation, 658 Ohio street, Buffalo 3, N. Y., has found recent application in passenger coaches. Wide panels of the metal extend from the window ledge to the heat covers next to the floor line and throughout the entire length of both sides of the coaches.

Characteristics of the metal include resistance to scuffs and mars and small maintenance and cleaning requirements. Being stainless it can readily be cleaned with a damp cloth, and the textured surface produced by the Rigidized pattern serves to hide scratches, scuffs and fingermarks which ordinarily would mar plain polished sheets. The texture also eliminates direct mirror reflections which occur with plain polished sheets, and diffuses light rays which might otherwise cause glare.

The clear-through patterns produce an extra rigidity which eliminates the buckling and bulging often experienced in applying sheet metal over large areas. This permits the use of maximum-size sheets which reduces the number of joints and seams, and generally speeds construction. Rigidized Metal is produced in sheet and strip form either ferrous or nonferrous, solid or perforated.

Railroad Banding Lathe

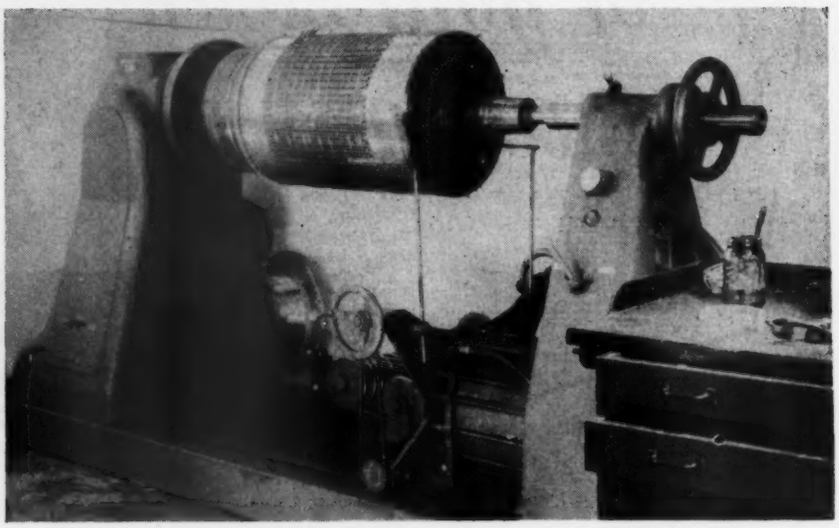
A special banding lathe for applying and rolling bands on Diesel-electric traction motor and generator rotors is announced by the Globe Tool & Engineering Company, 438 Davis avenue, Dayton 3, Ohio. It is identified as model BL-40, and has a 40-in. swing diameter and 60-in. length from face plate to tailstock live-center for shaft accommodation, with sufficient strength to accommodate up to 8,500-lb. rotors.

Banding wire which is drawn from the supply spool mounted on the dereeler spindle, extending from the rear of the headstock, with suitable preliminary tensioning mechanism and permanently threaded over the take-up pulleys, is fed onto the rotor by the carriage traversed by the handwheels provided for that purpose. Handwheels as shown, or larger handwheels with capstan handles are available, although while feeding the wire with either preliminary or rolling tension, the carriage is light and easy to control.

Upon completion of the feeding of the band wire onto the armature, it is cut loose from the supply spool and tied off in the usual manner. Pressure is then applied to the air cylinder, expanding the takeup system for a calibrated rolling tension. Although up to 1,000 lb. tension may be applied to the wire, with 100 lb. air pressure, a pre-set safety valve prevents tension from approaching the fracture point of the wire. Actual rolling tension then may be applied to the wire as desired for best results, being conveniently adjustable by the operator.

The rotor may be driven in either direction of rotation at a selected speed of from 15 to 60 r.p.m. and complete control of the machine is conveniently accessible from either side. Thus, the operator may work from one side or both sides of the machine as he wishes.

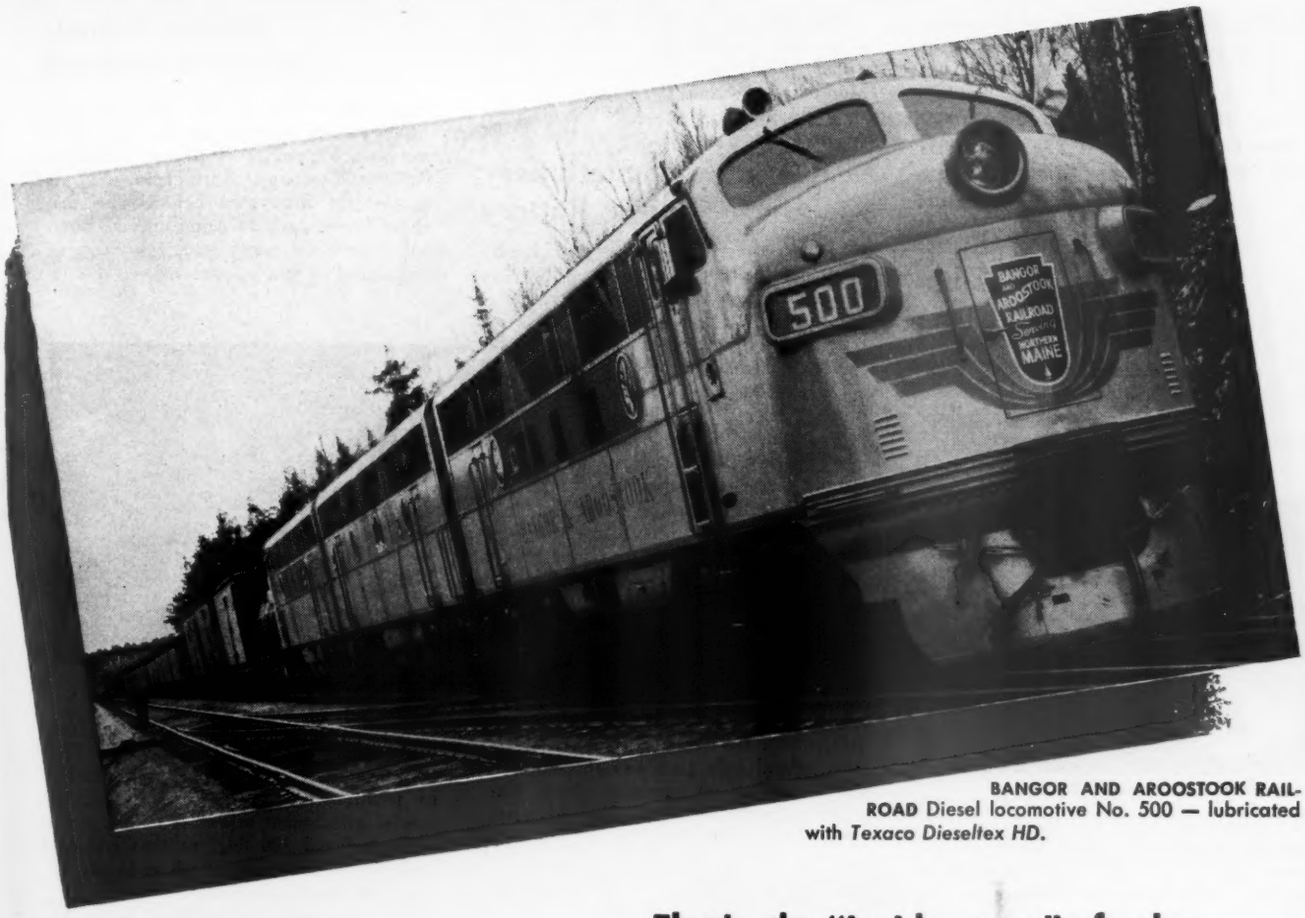
Approximately 21 feet of slack wire may be withdrawn (without resetting) at the rolling pressure. This, in most cases, will be more than sufficient to seat the windings firmly during the hot banding process of the preliminary rolling operation. Of course, much less wire is to be withdrawn in the final banding operation.



Fabric Hoods For Dusty Locations

These loose-fitting dust hoods, which weigh only 5 oz., have many uses where dusty and paint-spray atmospheres are prevalent. This includes such operations as cleaning boilers, furnaces or chimneys, painting and wherever dust or dirt is objectionable.

Ample visibility is provided through the large, clear plastic window and they



BANGOR AND AROOSTOOK RAILROAD Diesel locomotive No. 500 — lubricated with *Texaco Dieseltex HD.*

Diesels Stay Cleaner

That's the "inside story" of why more and more locomotives are being lubricated with Texaco Dieseltex HD

CLEAN top decks . . . free rings . . . absence of harmful carbon, varnish and gum . . . minimum wear . . . you'll find all these at scheduled overhaul periods when engines are lubricated with *Texaco Dieseltex HD.* These benefits mean more mileage between overhauls, better performance, greater efficiency and economy.

Texaco Dieseltex HD designates the finest in railroad Diesel engine lubricating oils . . . detergent and dispersive oils that meet the most exacting requirements of leading Diesel locomotive builders and the most severe conditions of operating service. An exclusive formula containing a special heavy-duty additive assures exceptional resistance to oxidation and sludge formations.

Talk to a Texaco Lubrication Engineer — a practical railroad man who'll be glad to explain how Texaco Products and unique Systematic Engineering Service can help you get the best performance at lowest cost from your Diesels. Call the nearest Railway Sales Division office listed below, or write The Texas Company, *Railway Sales Division,* 135 East 42nd Street, New York 17, N. Y.

NEW YORK • CHICAGO • SAN FRANCISCO • ST. PAUL • ST. LOUIS • ATLANTA

TEXACO

TEXACO Dieseltex HD

FOR ALL RAILROAD DIESELS

Tune in . . . TEXACO STAR THEATRE presents MILTON BERLE every Wednesday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

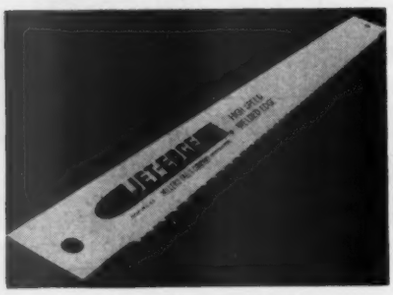
may be worn with goggles or respirator.

A product of General Scientific Equipment Company, 2700 W. Huntingdon st., Philadelphia 32, Pa., the hoods made of fabric are supported by a head frame which covers and protects the face, head and neck down to the shoulders.

Hacksaw Blade With Welded Edge

A super high speed hacksaw blade that is shatterproof and unbreakable has been introduced by the Millers Falls Company, Greenfield, Mass.

Named Jet-Edge, the manufacturer claims it cuts faster, more accurately,

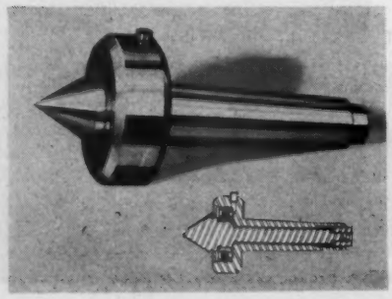


and longer because its unbreakable back can be tensioned higher, faster speeds used, and greater feed pressures applied, without blade deflection. Savings in cutting costs of 20 to 50 per cent have been reported and the blade has met all safety requirements in the plants where it has been tested.

Blade prices are the same as those of tungsten high speed blades. They are immediately available from mill supply distributors handling this type of apparatus.

Live Center for Lathe

A live center has been designed by the South Bend Lathe Works, 403 East Madison street, South Bend 22, Ind., to give strength and rigidity for heavy roughing cuts and accuracy for fine work and high speeds. The revolving center is made from electric furnace tool steel heat treated to a hardness of 61 to 65 Rockwell C. The center point shaft extends through the taper shank and is supported by bearings at both ends. Both radial and thrust loads are carried by a ball bearing, and a rear pilot bearing is incorporated to eliminate center point whip. All parts are interchangeable and replaceable.



This live center is available in two sizes. The smaller has a No. 2 Morse Taper shank and the larger a No. 3 Morse Taper shank.

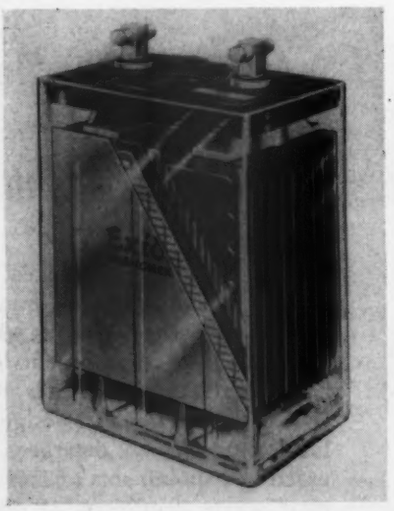
Stationary Power Battery

A new battery, known as the Exide-Manchex, has been announced by The Electric Storage Battery Company, Philadelphia, Pa. It is of the sealed glass jar type and applicable to all types of stationary control and power requirements.

Long life, low maintenance cost, improved electrical characteristics, increased power output per unit of space, less weight per amp.-hr. output, and attractiveness of appearance, are the principal features of the Exide-Manchex.

The positive plate is the Manchester type which consists of a grid cast of a lead antimony alloy in which the active material is in the form of pure lead buttons.

The "Permanized" negative plate is constructed of a lead antimony grid or framework with a series of vertical ribs connected by short horizontal bars. These bars, which are flush with the plate surface, extend only part way through and are staggered on opposite sides. The active material is in the form of strips



or ribbons of sponge lead, extending from top to bottom of the plate between the ribs and locked in position by the horizontal bars.

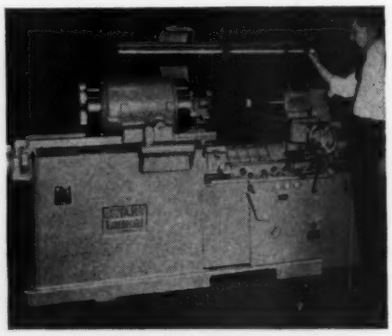
The separators are of treated wood, teamed with low resistance, slotted plastic separators.

High rate discharge characteristics are obtained from these cells because of the heavy terminal posts equipped with copper inserts (except in the three smaller size cells) and the heavy straps between the plates and terminal posts. The cells also have a burned ring seal where the post is fitted through the cover. This permanently seals the opening around the posts and eliminates electrolyte seepage.

The jar is of molded glass, and the deep seal covers are made of tough rubber.

Double Chuck Grinder Workhead

A demonstration of the size of work which can be chucked on the No. 112-M machine, a product of Bryant Chucking Grinder Company, Springfield, Vt., is graphically illustrated below. The machine is designed to grind special internal tapers on parts such as machine tool spindles and special axles. The in-



side and outside diameters and the face can be ground at one chucking. The workhead can be moved longitudinally to position the work for grinding. A special attachment allows the work-piece to be indexed 180 deg. so that concentricity is assured when both ends of the piece are to be finished.

For large work, the workhead is moved to the left end of the machine and a steadyrest is used to support the end to be finished. This workhead can be removed and replaced by a fixture so that spindles can be ground while rotating on their own bearings. Its base is of the swiveling type, providing for grinding a maximum included angle of 30 deg.

To facilitate loading of long pieces, the wheelhead assembly is moved hydraulically to the rear of the machine. Multiple position stops can be provided for grinding step bores.

Plastic Finish

A water-clear plastic finish has been developed that dries to a glossy, durable, long-wearing coating to protect the exterior and interior finishes of railroad passenger rolling stock from wear and tear, weather, corrosion, dust and smoke. Exterior surfaces can be sprayed with the new plastic and the car put back in service again within 60 hours. It can be wiped on with a cloth to car interiors to protect window sills, varnished or finished surfaces, tables, walls, leather furniture and linoleum floors. The finish is touch dry in 20 minutes and hard dry in eight hours.

The plastic acts as a sealer. It is not a paint, varnish or lacquer. It is said to be impervious to heat, cold, moisture, alkalis, fruit juices and most chemicals and highly resistant to caustic soaps.

This plastic is a product of the Reyam Plastic Products Company, 1525 East 53rd street, Chicago 15.

GM Diesels on the Great Steel Fleet

A fleet of twenty-two 4000 H.P. General Motors Diesel locomotives, used in the hauling of the New York Central's "Great Steel Fleet" of trains between Harmon or Boston and Chicago, St. Louis and Cincinnati, has averaged 27,895 miles a month per locomotive since the first went into service in March 1945.

The list of trains includes such famous names as the 20th Century Limited, the Empire State Express, the Lake Shore Limited, the Commodore Vanderbilt, the North Shore Limited, the Wolverine, the Pacemaker, the Southwestern Limited and the Ohio State Limited.

Four 2000 H.P. General Motors Diesel units went into service in March 1945, eight more in October 1945, twenty more in April 1947 and twelve more in February 1948. Total mileage made by the first four units through September 1948 was 4,692,986.

The average of 27,895 miles a month for all twenty-two locomotives (44 units) was accompanied by an average availability of 86.93%, *based on the number of hours available to total potential hours.* This enabled the locomotives to meet their assignments an average of better than 95% of the time.

Records like this make it easy to understand why more and more of America's railroads are using more and more General Motors Diesel locomotives to power their finest trains.

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE

DIVISION OF GENERAL MOTORS, LA GRANGE, ILL.

Home of the Diesel Locomotive

NEWS

Martin Assistant Mechanical Engineer, Mech. Div.

W. M. MARTIN, master mechanic of the Elgin, Joliet & Eastern at Gary, Ind., has resigned to become assistant mechanical engineer, Association of American Railroads, Mechanical Division, with headquarters at Chicago.

Mechanical Division Circular Letters

PROPER MATING OF GEARED HAND BRAKE PARTS

IN a letter dated February 4, attention is directed to cases where one type or make of geared hand brake is substituted for another type in repairs without changing the bell crank which, in many cases, adversely affects the operation or efficiency of the complete hand brake assembly.

The bell crank is an essential part of the complete assembly and A. A. R. Certificates of approval are awarded on the basis of laboratory tests which include a design of bell crank regularly furnished by the manufacturer with the particular type of hand brake submitted for test. Therefore, it is essential that the proper combination of hand brake mechanism and bell crank designed for use therewith, be maintained.

The circular letter, issued on behalf of the Committee on Geared Hand Brakes, urges the issuance of general instructions that whenever a geared hand brake of a different type is substituted, the bell crank must also be changed, to keep the standard combinations of mechanism and bell crank for each make or type of brake.

RECLAMATION OF CAR REPAIR MATERIAL

A circular letter dated April 28, 1948, has to do with the purchase of reclaimed car repair material from second-hand dealers for repairs to cars moving in interchange service.

Further checks made by the Mechanical Inspection Department of reclamation practices employed by second-hand dealers indicate that the rules and standards approved by the association are not being fully complied with in all cases.

Some of the exceptions noted were as follows: (1) Couplers and truck side frames reclaimed by welding without proper heat treatment and marking as required by Interchange Rule 23; (2) brake beams identified as R. S. S. & T. without having been repaired in accordance with A. A. R. standard specifications.

To avoid the possibility of cancellation of charges for car repair items applied to foreign cars which fail to meet A. A. R.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE FEBRUARY ISSUE

LOCOMOTIVE ORDERS

Road	*No. of locos.*	*Type of loco.*	*Builder*
Chicago & North Western	45[1]	1,500-hp. Diesel-elec. frt.	Electro-Motive
	5	1,500-hp. Diesel-elec. road switchers	Baldwin Loco.
	4	1,000-hp. Diesel-elec. yard switchers	Fairbanks-Morse
	2	2,000-hp. Diesel-elec. hump yard switchers	Electro-Motive
Erie	4	1,000-hp. Diesel-elec. switch.	Lima-Hamilton
	5	1,000-hp. Diesel-elec. switch.	Baldwin
Norfolk & Western	7[2]	2-8-8-2 freight	Co. shops
	3[3]	2-6-6-4 frt. or pass.	Co. shops
	3[3]	4-8-4 passenger	Co. shops

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	Builder
Canadian Pacific	400	50-ton box	Pullman-Standard
Denver & Rio Grande Western	50	50-ton gondola	Bethlehem Steel
Mather Stock Car Co.	50	40-ton refrigerator	Co. shops
Northern Pacific	500[4]	70-ton hopper	Pressed Steel Co.

FREIGHT-CAR INQUIRIES

Chicago & North Western	1,000	50-ton box
Delaware, Lackawanna & Western	250-500	50-ton gondola
Northern Pacific	750	50-ton box

PASSENGER-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Chicago, Burlington & Quincy	30[5]	Suburban passenger cars	Budd Co.

[1] Thirty "A" units; 15 "B" units.
[2] The 2-8-8-2's will be compound Mallets of Class Y6B; the 2-6-6-4's, Class A single-expansion articulated locomotives, and the 4-8-4's, Class J.
[3] For May delivery.
[4] Delivery to start in June.
[5] Part of an $8,500,000 program to modernize and Dieselize the road's suburban equipment. Delivery is scheduled for next year. The cars will be of the gallery-type with two levels, each car carrying 148 passengers, and each will be 15 ft. 8 in. high. There will be double seats for 96 passengers on the lower level and single seats for 52 passengers on the upper level.

NOTES:

Erie—The Erie has announced a 1949 program of service improvements, including Dieselization of 63 main line commuter and local trains between Jersey City, N. J., and Port Jervis, N. Y., that will cost $3,300,000. Also included in the program are cooling system improvements in commuter coaches, redecorating interiors and reupholstering seats in 144 coaches, modernizing facilities for faster ticket service at Jersey City, installing an automatic car-washing machine, and construction of Diesel locomotive maintenance facilities at Jersey City. Further studies are in progress on the advisability of Dieselizing other commuter trains, including those on branch lines.

Pennsylvania—Complete Dieselization of the Pennsylvania's Grand Rapids division, at a cost of approximately four million dollars, is being effected upon delivery of seven more locomotives. These additional Diesels, together with 16 already assigned to the division, will replace 37 coal-burning steam-locomotives. The enginehouse at Grand Rapids will be rebuilt as a Diesel shop and will handle progressive maintenance on all the division's locomotives. Light maintenance will be done at Kalamazoo, Cadillac Muskegon and Petosky.

Western Fruit Express Company—The Western Fruit Express Company has transferred to the Pacific Car & Foundry Co. from its own shops an order for 250 40-ton refrigerator cars.

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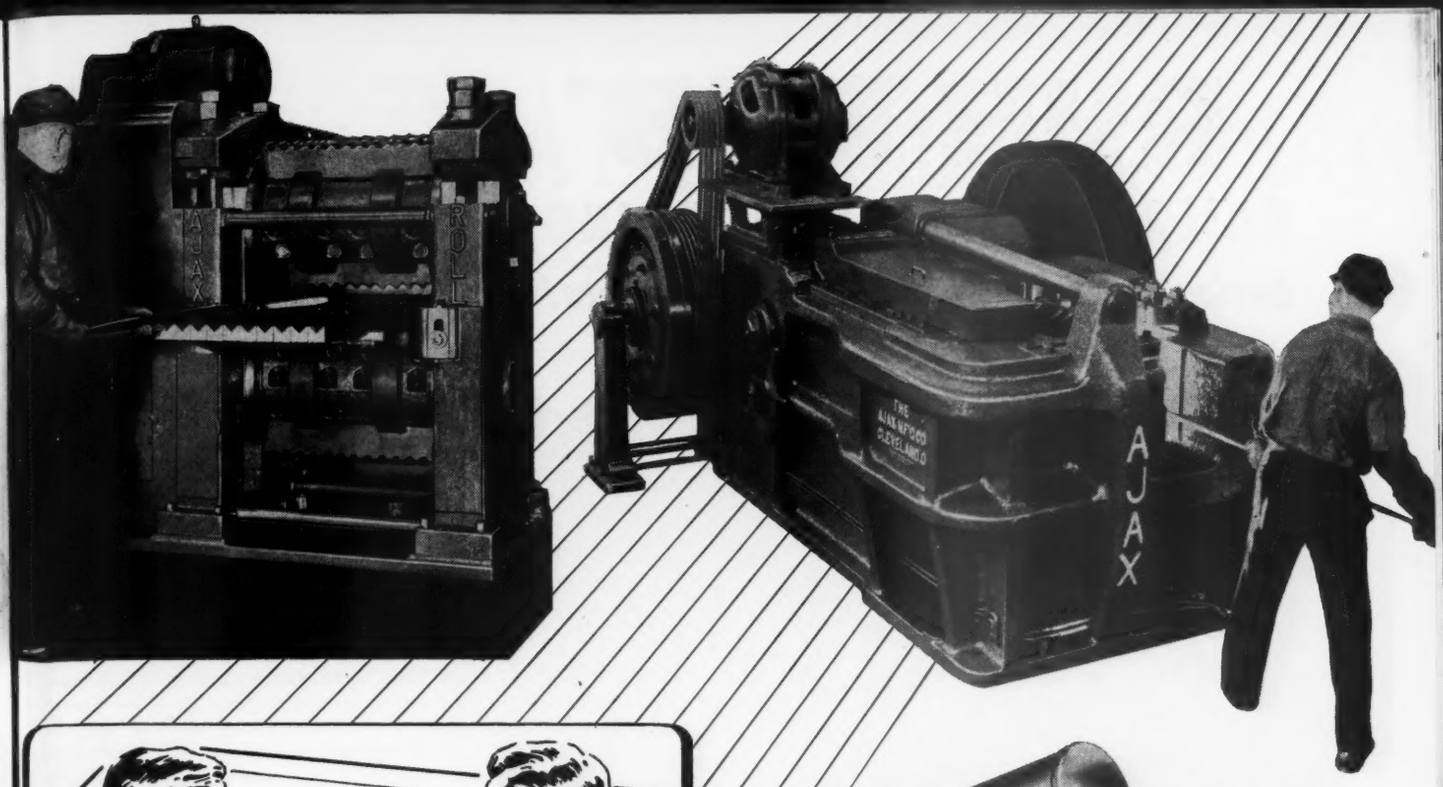
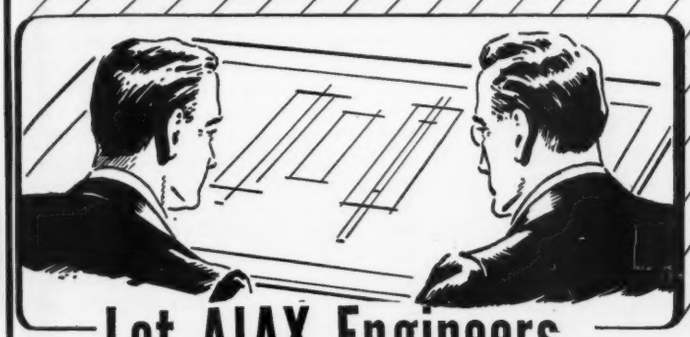
The new Diesel locomotive parts center of the Electro Motive Division of the General Motors Corporation at La Grange, Ill. **(See Supply Trade Note page 229.)**





Let AJAX Engineers Aid You In Selecting *Forging Machinery*

Ajax engineers, thoroughly experienced in forging processes and forging machinery, can be of valuable assistance to the persons responsible for efficient forging production.

The Ajax Manufacturing Company manufactures a complete line of forging machinery - - - Forging Machines, Forging Presses, Forging Rolls etc. Ajax engineers, with the knowledge gained through research and development within their plant and through constant contact with the most progressive forge plants in the country, are experts in the field of forging. Whether your problem concerns the selection of one piece of forging machinery for the forging of a single part, or a multiple unit production line set-up from bar stock to the trimmed forging, Ajax engineers will welcome the opportunity to assist you wherever possible.

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RUB-BUB*

RAILROAD SAFETY FLOORING

Outlasts steel! Reduces pay accidents!
Used by 7 Class 1 roads!

RUB-BUB SAFETY AISLE TREAD (Dri-Foot rib design) and Rub-Bub Safety Underseat Flooring (Dri-Foot knob design) are both made of a full 3/16 inch thickness of sinewy Rub-Bub synthetic compound with integral fabric backing. Microphotograph (enlarged 30 diameters) shows dense, fibrous texture of Rub-Bub compound that's never slippery *wet or dry.*

CHOICE of day coach flooring is no trivial matter. That's why it will pay you — in fewer accident claims and lower maintenance costs — to specify RUB-BUB railroad safety flooring.

Its toothy texture is as safe *after years of service* as the day installed. Wide grooves in the aisle tread drain water *faster* . . . squeegee ribs grip shoe soles *tighter.* Knob design of underseat flooring keeps feet high and dry.

And with RUB-BUB flooring there's no costly replacement resulting from premature wear. Tough RUB-BUB synthetic rubber compound lasts for years with no sign of wear. Abrasive dirt accumulates in deep grooves *below* contact surfaces . . . integral fabric backing prevents excessive "growth."

Exclusive Dri-Foot design is also a feature of RUB-BUB vestibule plate, step plate and white safety step edge. Installed throughout a day coach, they make an ideally matched installation—for improved appearance . . . greater safety . . . longer life. Write for a RUB-BUB sample and see for yourself why it is *the big value in railroad flooring.*

STEP PLATE WITH WHITE SAFETY EDGE
ALL-BLACK STEP PLATE. BOTH STEP PLATES HAVE NATURAL RUBBER EDGE, SYNTHETIC RUBBER TREAD.
VESTIBULE PLATE

RUB-BUB
Transportation Products

SAMUEL MOORE & CO. MANTUA, OHIO

IN CANADA | RAILWAY & POWER ENG. CORP.
Montreal • Hamilton • Windsor
Toronto • North Bay • Winnipeg
Vancouver • Noranda • New Glasgow

*T. M. REG. U.S. PAT. OFF. A-2018

specifications for reclaimed material, it is suggested in a circular letter dated February 4, 1949, that mechanical department officers confer with purchasing and stores department officers and instruct them as to the existing requirements where purchase of car repair material from second-hand dealers is contemplated. The same care is also urged in use of car repair material which has been reclaimed at railroad company shops.

1948 Freight-Train Performance

AMERICAN railroads carried more tons of freight per train in 1948 than ever before and with an increase in average speed, according to the Association of American Railroads. At the same time, a new high record was established in freight-train performance per hour.

The average load of freight per train in 1948 was 1,176 tons, 30 tons above the previous high record established in 1947, when the average was 1,146 tons. It also was an increase of 37 tons above that in 1944, the peak war year. In 1929, the average was only 804 tons. The average speed of freight trains in 1948, as the A.A.R. put it, "was slightly higher than in any of the preceding six years and was nearly 23 per cent higher than in 1929."

Tons of freight moved one mile for each hour of freight train operation averaged 18,779 in 1948, compared with the previous high of 18,126 ton-miles in 1947 and 10,580 in 1929. The performance in 1948 was greater by 6.6 per cent than the wartime record of 17,623 ton-miles per hour attained in 1944.

William S. Wollner Dies

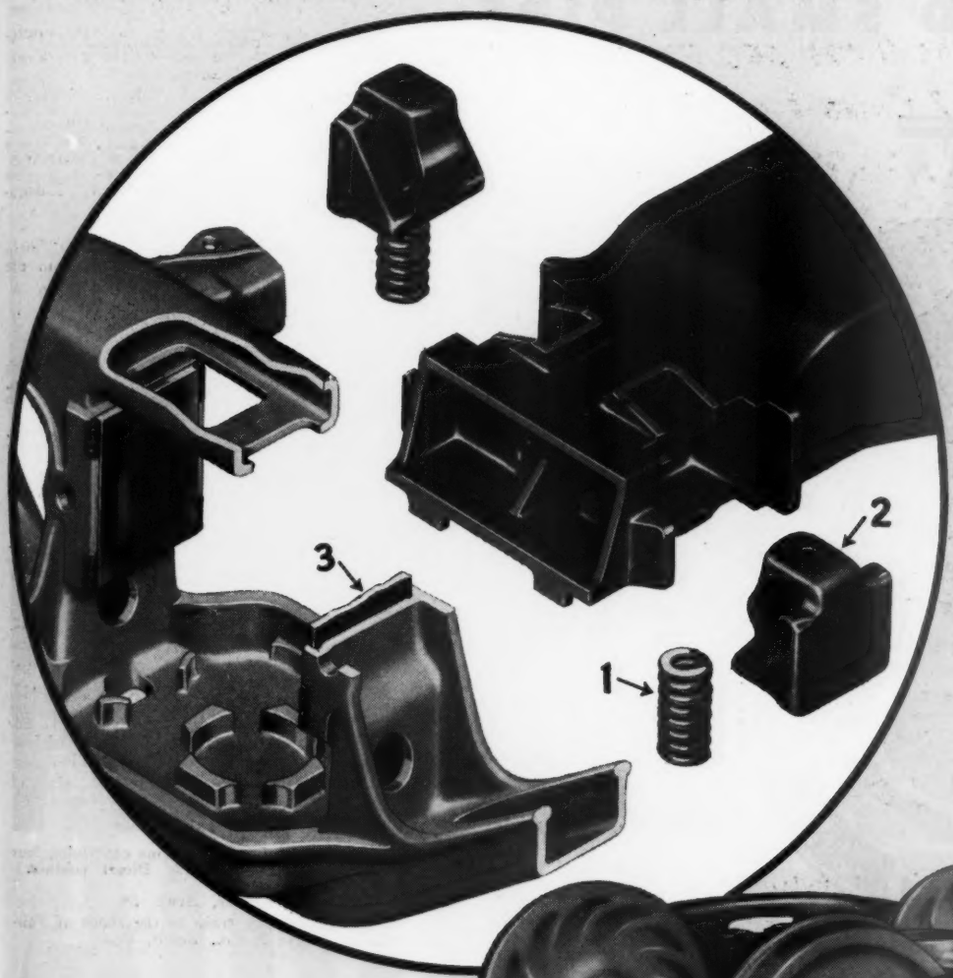
WILLIAM S. WOLLNER, who had been secretary of the Pacific Railway Club for 32 years, died suddenly on February 5.

A.S.M.E. Oil and Gas Power Conference

THE 1949 Oil and Gas Power Conference sponsored by the Oil and Gas Power Division, in co-operation with the Railroad Division and the Chicago Section of the American Society of Mechanical Engineers, will be held at the Hotel Sherman, Chicago, April 25-29. The conference, in addition to the technical program, will feature a special preconference lecture program for which special registration will be required; an exhibit of Diesel engines, accessories, and instruments, and inspection trips to the local Diesel plants.

Registration fee for the conference will be $2.50 to members and $5 to non-members. Registration for one day will be $1.25 and $2.50, respectively. Registration for the lecture course, to be given on Monday, April 25, will be $12 for A.S.M.E. members and $15 for non-members, payable in advance to John C. Gibb, Room 1323, Socony-Vacuum Oil Company, 26 Broadway, New York 4. The course will consist of three lectures on Cooling of Internal-Combustion Engines, Fundamentals of Air Flow in Diesel-Engine Manifolds, and Reduction of Noise in Engines. The lecturers will be B. Pinkel,

Built to BEAT High Maintenance



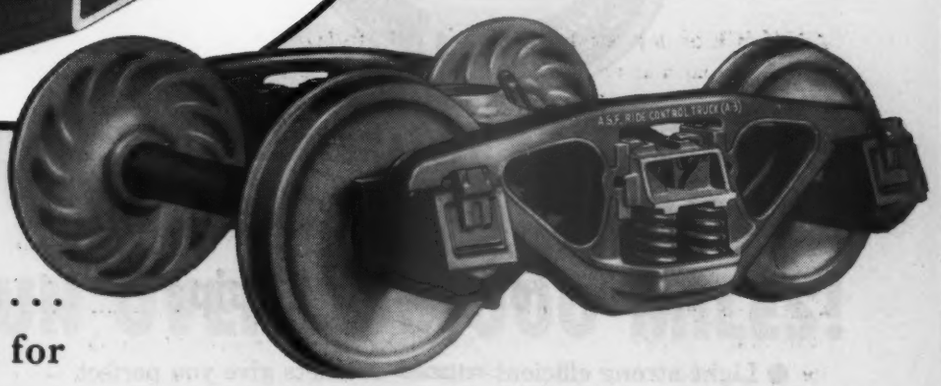
FEW PARTS!

LOW-STRESSED CONTROL SPRINGS!

RUGGED STEEL CASTINGS!

GENEROUS FRICTION SURFACES!

1. *Ride-Control Spring.*
2. *Friction Shoe.*
3. *Friction Plate.*



Simplicity and stamina . . . the two requirements for dependable, low-cost operation . . . are *combined* in the Ride-Control Truck with the two essentials of an easy ride—long spring travel and constant friction control.

A-S-F *Ride-Control* TRUCK

CONSTANT FRICTION CONTROL

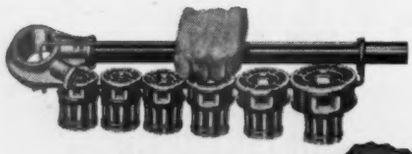
LONG SPRING TRAVEL

AMERICAN STEEL FOUNDRIES

MINT MARK OF ⬡ FINE CAST STEEL

Now it's a Cinch

TO THREAD SMALL PIPE



Free handy carrier for any group of sizes.

RIDGID Ratchet Threaders No. 00R, 111R and 12R are extra handy for 1/8" to 2" pipe

● Light strong efficient RIDGID ratchets give you perfect threads on 1/8" to 2" pipe — fast, without bothersome get-ready. Precision cut tool-steel dies. Die heads snap into ratchet ring from either side, can't fall out. You don't need special dies for close-to-wall threads. No. 00R, 1/8" to 1" pipe; No. 111R, 1/8" to 1¼"; No. 12R, 1/8" to 2." Conduit dies furnished on request. Buy these handy work-savers at your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO

Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics; W. W. Hagerty and L. Talbot, professors, University of Michigan, and W. P. Green, professor, Illinois Institute of Technology.

The technical program is as follows.

TUESDAY, APRIL 26
2 p.m.
Session I

Dynamic Analysis of Valve Springs, by Troels Warming, assistant professor of mechanical engineering, University of Wisconsin.

Vibration in Valve Mechanism, by Troels Warming.

Effects of Cylinder Pressure Rise on Engine Vibrations, by J. O. Hinze, "Delft" Laboratory, Royal Dutch Shell, Holland.

8 p.m.

General Technical Committee Meeting in which members and guests interested in the oil and gas-power field may participate.

WEDNESDAY, APRIL 27
9 a.m.
Session II

Two-Cycle Dual-Fuel Diesel Engine with Automatic Fuel Conversion, by E. L. Conn, R. H. Beadle and G. A. Schauer, research staff, Fairbanks, Morse & Co.

Diesel Locomotive Engine Cooling System, by F. H. Brehob, Locomotive Engineering Division, General Electric Company.

Ignition System for Oil Engines, by H. B. Holthouse, Holthouse Laboratory.

1:30 p.m.

Inspection trip to new Diesel locomotive repair shops of the Chicago & North Western.

THURSDAY, APRIL 28
9 a.m.
Session III

A Training Program for Railroad Personnel, by George Y. Taylor, supervisor, education department, locomotive division, American Locomotive Company.

Diesel-Engine Maintenance Instruction, Alco V Type Engine, by S. E. Lodge, education department, locomotive division, American Locomotive Company.

1:15 p.m.

Inspection trip to La Grange, Ill., plant of Electro-Motive Division, General Motors Corporation.

2 p.m.

Inspection trip to submarine containing four 1,600-hp. Fairbanks-Morse Diesel engines.

FRIDAY, APRIL 29

All-day trip by train to the shops of Fairbanks, Morse & Co., Beloit, Wis.

Miscellaneous Publications

DROP FORGINGS. Drop Forging Association, 605 Hanna Building, Cleveland 15, Ohio; 60-page booklet, entitled "Metal Quality." Booklet, issued by the Technical Committee of the Association for design engineers, metallurgists and production and management executives, describes and illustrates the development of metal quality progressively throughout hot-working operations, from the blast furnace to the finished forging. Discusses forging quality steel; proper selection of metals for forgings; steps in making forging dies; methods and equipment used in hot working steel by forging, and various forging procedures.

◆

PERMITE ALUMINUM ALLOY CASTINGS. Aluminum Industries, Inc., Cincinnati 25, Ohio; 80-page booklet; spiral plastic binding. Discusses the history and growth of Aluminum Industries, Inc.; Permite's facilities; aluminum and its advantages; types of Permite aluminum-alloy castings; sand, permanent mold, semi-permanent mold, and die castings; relative characteristics of Permite casting processes;

Andok B IN THIS TEST

HAS RUN OVER 270,000 MILES!

DURING TEST no additional grease has been added! ...inspection shows bearings in journal box are in excellent condition!... Esso **ANDOK B** has maintained its remarkable lubrication qualities even after the 270,000-mile record was set... and the road test is *still going on!*

FIELD TESTING like this on Esso Railroad Fuels and Lubricants is one of the practical follow-ups on the extensive research Esso constantly carries on in America's largest petroleum laboratories...making *doubly sure* you can *depend* on the railroad products that bear the Esso brand.

CALL IN our Esso Sales Engineer on *any* fuel or lubrication problem that we can help you solve.

The Sign of QUALITY — Esso — The Symbol of SERVICE

RAILROAD PRODUCTS

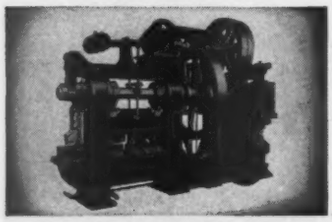
SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., Ga.

ESSO STANDARD OIL COMPANY—Boston, Mass.—New York, N. Y.—Elizabeth, N. J.—Baltimore, Md.—Richmond, Va.—Charleston, W. Va.—Charlotte, N. C.—Columbia, S. C.—Memphis, Tenn.—Little Rock, Ark.—New Orleans, La.

ESSO STANDARD OIL COMPANY OF PENNSYLVANIA—Philadelphia, Pa.

BEATTY No. 11-B Heavy Duty Punch widely used in railroad industry.

BEATTY combination Press Brake & Flanger does flanging, V-bending, pressing, forming, straightening.



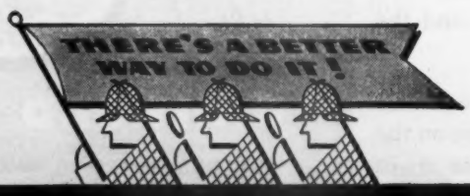
BEATTY CoPunShear, one unit does coping, punching, shearing.

BEATTY Hydraulic Vertical Bulldozer for heavy forming and pressing.

BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.

we're WISE
TO A LOT OF
PRODUCTION PROBLEMS

BEATTY-*engineered* heavy metal working equipment is on the job in hundreds of important plants, doing a wide variety of jobs. Yet, each machine is individually engineered to do its specific task better, faster, at less cost. This wide range of experience is your assurance of expert counsel, advanced engineering, finest quality construction. There's a better way to handle any heavy metal fabricating problem. Our job is to help you find that better way. If you have a problem, write us. We may have the answer.



HYDRAULIC HEAVY METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

Permite aluminum alloys and their applications; heat-treatment; designing, joining, and finishing Permite aluminum alloy castings, etc.

Supply Trade Notes

WESTINGHOUSE AIR BRAKE COMPANY.—*J. F. Graham* has been appointed representative of the Westinghouse Air Brake Company, in charge of the Los Angeles, Calif., office.

Mr. Graham joined the Westinghouse company in June, 1940, as a tester at Wilmerding, Pa., and later served as industrial engineer in the engineering department. He was assigned to the San Francisco, Calif., office in November, 1947, as industrial representative.

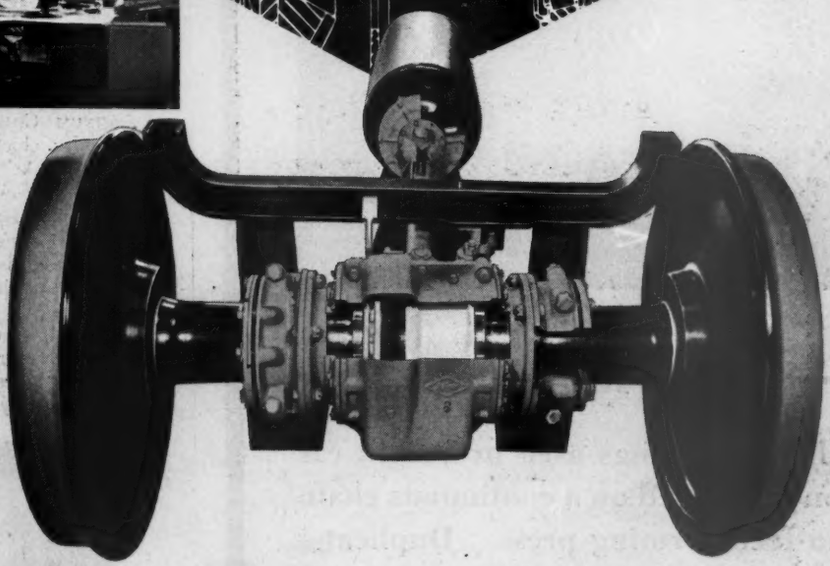
J. F. Graham

◆

GENERAL MOTORS CORPORATION, ELECTRO-MOTIVE DIVISION.—The new Diesel locomotive parts center of the Electro-Motive Division at La Grange, Ill., is now in full operation. From this center parts will flow to six other strategically located Electro-Motive distribution centers, as well as fill consumer demand direct. The center has 155,000 sq. ft. of floor space, glass walls, complete forced air heating and ventilating, and air-conditioned offices which occupy the entire front of the building. A 30-ft. high loading section, extending along the west end, and an area for storage and operating purposes complete the three major sections of the center. The layout of each section, with wide aisles throughout the building, permits mechanized handling of parts. Advanced methods in storekeeping and in scientific packaging insure rapid movement of parts both in and out. Other parts centers which help to furnish the railroads with nearby re-

KEY FEATURE No. 13

THE SPICER RAILWAY GENERATOR DRIVE IS ENGINEERED FOR EFFICIENCY!



THE SPICER RAILWAY GENERATOR DRIVE is designed and built by specialists in railway generator service. The drive is the positive type, and being fully protected, is not affected by ballast, dirt, snow, rain, sleet, or hot and cold weather. This assures a high degree of efficiency and fully charged batteries at all times, even under adverse operating conditions.

The mechanical efficiency of the drive, as determined by actual laboratory tests under a load of 20 K. W., is 98.3 per cent at 30 MPH. When used with the automatic clutch, the additional starting load on the locomotive is eliminated, as the automatic clutch does not engage until a speed of 8 to 12 MPH has been reached.

There are more than 5,000 Spicer Generator Drives in operation on over 50 different railroads. Write for full information on what the efficient Spicer Positive Generator Drive can do for your railroad!

45 YEARS OF Spicer SERVICE

Positive Generator Drive

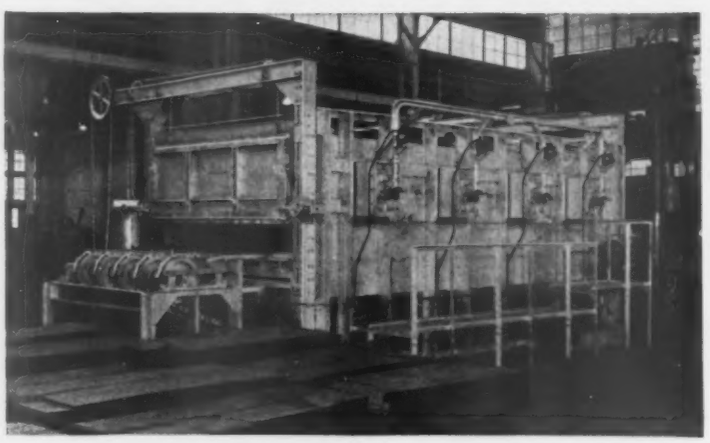
Manufactured, Sold and Serviced by SPICER MANUFACTURING

Division of Dana Corporation • TOLEDO 1, OHIO

Now JOHNSTON

CONTINUOUS PLATE HEATING FURNACES

for Manufacture of Raiload Cars



Proving Outstanding Production Results in two Railroad Shops

Plates for large pressings used in freight car construction are heated on a continuous chain conveyor to feed forming press. Duplicates results, speeds production and lowers costs.

Oil fired with JOHNSTON "Reverse Blast" Proportioning Burner — 2 zone automatic control — variable speed conveyor drive with Automatic chain take up — these are tested engineering features available in Johnston Furnaces.

Manufactured in standard 8′ – 6″ wide x 20′ – 0″ long and 10′ – 0″ wide x 19′ – 0″ long sizes. Other sizes to suit shop conditions and standard procedures.

Further information furnished upon request.

THE JOHNSTON LINE — SAFETY DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

serves of parts are located in Jacksonville, Fla.; Halethorpe, Md.; Los Angeles, Calif., and Emeryville; St. Louis, Mo., and Minneapolis, Minn. At Argo, Ill., a short distance from the La Grange central warehouse, is another building of 115,000 sq. ft. which houses bulk storage of parts for locomotives and rail cars of models as far back as 1924. Five of the warehouse centers also provide factory repair facilities for large Diesel locomotive components, such as traction motors and generators. Another branch repair shop is being constructed at St. Louis.

◆

BULLARD COMPANY.—The Bullard Company, Bridgeport, Conn., has acquired the business and products of the *Universal Boring Machine Company* of Hudson, Mass. Manufacture of the horizontal boring mills will be continued at the Bullard plant. The machines will be known as Bullard-Universal boring machines and will be offered in three spindle sizes—3 in., 4 in., and 5 in. Bullard will also continue the manufacture of the Universal precision machine-aligning level in 18-in. and 27-in. lengths.

◆

ALUMINUM COMPANY OF AMERICA.—*A. H. Woollen*, chief engineer of the railroad division of the Aluminum Company of America at New Kensington, Pa., has assumed inactive status with the company for reasons of health.

Mr. Woollen is a graduate of the Baltimore Polytechnic Institute (1904). He served with the Pennsylvania, the Stone & Webster Engineering Corporation, and the Illinois Central in engineering capacities before his association with the Aluminum Company. During World War I

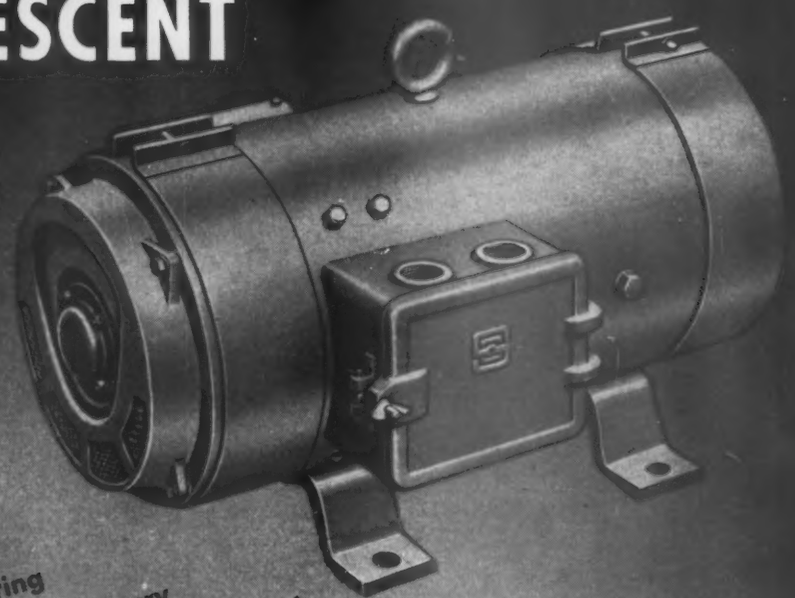
A. H. Woollen

was a captain in the ordnance department of the United States Army. Be became an engineer in the development division of the Aluminum Company 22 years ago and in 1944 was appointed chief engineer of the railroad division.

◆

GUY M. BEAN, for over 38 years a representative of the American Arch Company, at Los Angeles, Calif., has retired. Mr. Bean served a machinist apprenticeship on the Northern Pacific, and afterward attended the University of Minnesota for two years and Iowa State College for two years, studying mechanical engineering. He was then employed as a machinist, enginehouse foreman, di-

Check These Cost Saving Advantages of
"SAFETY" MOTOR ALTERNATORS for FLUORESCENT LIGHTING



- Longer life
- Easier to maintain
- Simplified car wiring
- Balanced circuits unnecessary
- Standard starting auxiliaries permitted
- Simpler and less expensive switchboard
- Inherent voltage and frequency regulation
- Frequency regulation plus or minus 2 cycles
- Voltage regulation plus or minus 6%
- Failure of one lamp has no effect on others
- Will operate all standard accessories and motors

Our new service manual No. 4031-A includes performance data. Copy sent free on request.

Safety Motor Alternators are available from .3 KW to 5 KW to convert all nominal DC voltages to 118 volts, 60 cycles AC

THE SAFETY CAR HEATING AND LIGHTING COMPANY INC.

NEW YORK · CHICAGO · PHILADELPHIA · ST. LOUIS · SAN FRANCISCO · NEW HAVEN · MONTREAL

● SAFETY COMPANY PRODUCTS INCLUDE: Complete Air-Conditioning Equipment • Genemotors • Generators • Motor Alternators Regulators • Lighting Fixtures • Switchboards • Fans • Parcel Racks • Generator Drives.

From the complete line of

OLIVER

CAR-BUILDERS' FASTENERS

Countersunk

RIBBED-BODY BOLTS

Made in diameters from ¼-inch to ¾-inch, lengths up to 6 inches, Oliver Ribbed-Body Bolts are used for boxcar, refrigerator car and other wood construction.

Oliver makes a complete line of car-builders' fasteners, as well as standard bolts, rivets, nuts and cap screws, and special fasteners.

We will gladly furnish samples and details of items in which you are interested.

OLIVER IRON AND STEEL *Corporation*

South Tenth and Muriel Sts. · Pittsburgh 3, Pa.

vision foreman, and general roundhouse foreman of the Atchison, Topeka & Santa Fe. In 1908 he entered the railway supply field, with the American Locomotive Equipment Company of Chicago. When the American Arch Company was formed in March, 1910, he became its representative, with headquarters in Los Angeles.

◆

AMERICAN STEEL FOUNDRIES.—*C. E. Grigsby*, whose election as vice-president of American Steel Foundries was announced in the March issue, will serve as direct assistant to *G. H. Snyder*, vice-president in charge of all sales, with headquarters at Chicago.

Mr. Grigsby is a graduate of the University of Michigan in 1923, with a

C. E. Grigsby

degree in mechanical engineering, after which he joined American Steel Foundries as sales engineer. He later was manager of specialty steel castings and assistant vice-president.

◆

DEARBORN CHEMICAL COMPANY.—*Earl M. Converse*, vice-president of the Dearborn Chemical Company, has been ap-

E. M. Converse

pointed senior vice-president, and *Eugene P. Fager*, assistant vice-president and technical director, has been elected vice-president and industrial department manager.

Mr. Converse, who has been associated

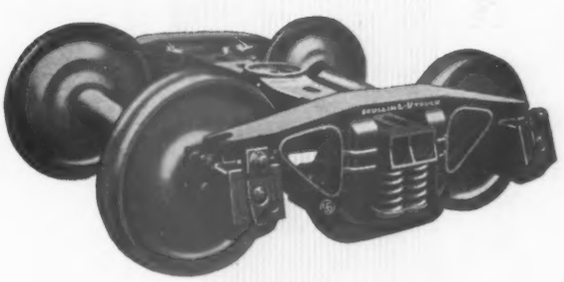
SCULLIN L-V TRUCKS protect your journal bearings, too

...AS WELL AS LADING, CARS AND TRACK

Actual service tests have proved that the lateral cushioning effect of the L-V Truck practically eliminates wear on the end surfaces of standard AAR journal bearings.

Since bearings are usually condemned because of worn ends long before their maximum crown wear has been utilized, this means substantial savings in replacement costs.

Roller bearings can also be applied if desired. Either way, you can depend on L-V Trucks to make fast freight *safe* for lading, cars and track ...with practically no maintenance!



50 YEARS' PROGRESS

SCULLIN STEEL CO.

SAINT LOUIS 10, MISSOURI

NEW YORK • CHICAGO • CLEVELAND • BALTIMORE • RICHMOND, VA. • MEXICO CITY, D. F.

A NEW HIGH
. . . IN BRONZE GATE VALVE DESIGN

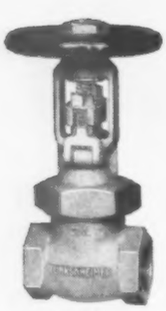
LUNKENHEIMER
200 LB. BRONZE *UNION BONNET* GATE VALVE

The new Lunkenheimer 200 Lb. Bronze Union Bonnet Gate Valve incorporates the first application of full cylindrical body sections in bronze gate valves. This construction, previously used only in higher pressure steel valves, provides great strength and maximum resistance against distortion of the valve body and seats due to internal pressure strains and other stresses. Tests made under the most severe conditions prove that this design will not distort and will maintain initial proportions and seat tightness.

In addition to the cylindrical body construction and other service-giving features, these valves employ Lunkenheimer's patented Alloy Stems which eliminate stem thread failure due to wear.

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U. S. A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

Fig. 2228—Screw Ends
Fig. 2229—Flange Ends
Double Disc, Rising Stem



O. S. & Y.
Union Bonnet
¼ to 2 inches
Fig. 2232 — Screw Ends
Fig. 2233 — Flange Ends
Wedge Disc, Rising Stem

Union Bonnet
¼ to 2 inches
Fig. 2230 — Screw Ends
Fig. 2231 — Flange Ends
Wedge Disc, Non-rising Stem

Complete information is given in Circular No. 534. Write to us for your copy today.

with Dearborn for 46 years, attended Armour Institute and Northwestern University. He served first in the company's laboratory and moved to the sales department in 1906. He became director of the specialty department in 1917, a director of the company in 1929 and vice-president in 1934. In 1947 the American Society of Metals awarded Mr. Converse the silver certificate for 25 years of meritorious service and contributions to the society.

Mr. Fager is a graduate of the University of Illinois. He joined Dearborn's laboratory staff in 1920. He became chief chemist in 1924 and, in 1928, sales department chemical engineer. He was elected a director in 1934 and assistant vice-president and technical director in 1941.

◆

WHITCOMB LOCOMOTIVE COMPANY.—*Roland C. Disney*, vice-president and general manager of the Whitcomb Locomotive Company, has resigned. *Charles K. Olson* succeeds Mr. Disney as general manager.

◆

OKONITE COMPANY.—*Albert F. Metz*, formerly vice-president and treasurer of the Okonite Company, has been elected president and general manager, to succeed the late Frank C. Jones. *Donald R. Stevens*, formerly a vice-president, has been elected executive vice-president and a member of the executive committee.

◆

MINNEAPOLIS - HONEYWELL REGULATOR COMPANY.—The assets of the *H. Belfield Company*, manufacturers of control valves, have been acquired by the Minneapolis-Honeywell Regulator Company. The former company will be operated as the

H. L. Murray

Belfield Valve division of Minneapolis-Honeywell, in charge of Vice-President *Howard L. Murray*, who was previously president of the Belfield Company.

◆

GENERAL STEEL CASTINGS CORPORATION.—*Luther A. Kleber* has been appointed assistant vice-president-manufacturing of the General Steel Castings Corporation, with jurisdiction over the Eddystone, Pa., and Granite City, Ill., plants, and headquarters at Granite City.

Mr. Kleber became associated with the

STEP UP *Shop Schedules* KEEP DOWN *Repair Costs*

Bullard 36" Cut Master machining pistons. Operations include boring for rod fit, counter-boring for piston rod nut, turning for cylinder fit and slotting for piston rings.

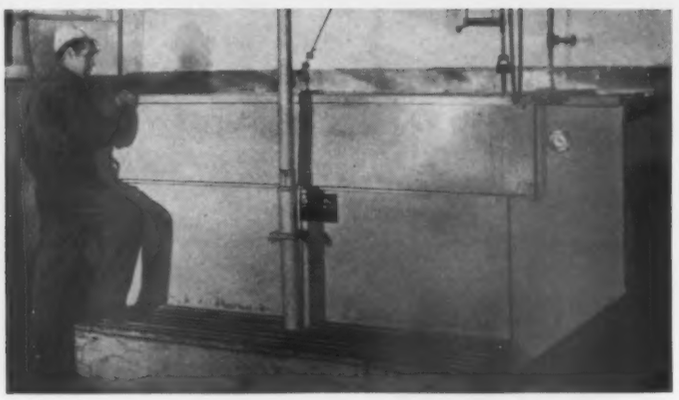
THE Bullard Cut Master Vertical Turret Lathe is aiding many railroads to speed locomotives through the shops and reduce costs through increased production, greater accuracy, decreased maintenance, and ease of handling. The Cut Master's sturdy construction and high horsepower rating permits a wide range of feeds and speeds and enables the Cut Master to take full advantage of the much higher productivity of modern cutting tools. The Cut Master not only "cuts time on cuts" but "cuts time between cuts." In the light of present conditions with respect to wages, taxes, and obsolescence of the machine tool inventory, the modern high production machine tools are the best solution to the locomotive repair problem. The Bullard Cut Master with all factors figures on a strictly accounting basis, pays for itself within from two to five years and the net return on invested capital is much higher than such capital could earn if otherwise employed.

Bullard Cut Master V.T.L.

THE BULLARD COMPANY BRIDGEPORT 2, CONNECTICUT

DIESEL PARTS CLEANING

You have the Problem
Here's the Answer...



On Diesel Parts and Other Railroad Cleaning Jobs

MAGNUS 755

- The perfect cleaner for stubborn carbonized oil deposits.
- Cleans thoroughly with minimum hand work.
- Cleans well in cold still tanks; better in warm solution, but best and fastest of all in the Aja-Dip Machine.
- Safe for *all* metals, and even for packings and gaskets.
- Lasting. When other cleaners of this type are exhausted, Magnus 755 is still going strong, with months of service ahead.
- Approved by the largest producer of diesel equipment.

MAGNUS AJA-DIP CLEANING MACHINES

- Provide dynamic mechanical agitation as well as chemical action.
- Speed cleaning by large margins. Heads cleaned in 4 hours that take 30 hours with ordinary cleaners.
- Eliminate hand work.
- Batch operation insures complete flexibility and dependable scheduling.
- Available in capacities to meet your cleaning program.
- Already in use for diesel parts cleaning in the shops of 9 of the big roads.

If you haven't investigated Magnus 755 and the Aja-Dip Machine, write for Bulletin 407-AST.

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.
In Canada—Magnus Chemicals, Ltd., 4040 Rue Masson, Montreal 36, Que.

RAILROAD DIVISION
Magnus
CLEANERS • EQUIPMENT • METHODS
Service representatives in principal cities

General Steel Castings Corporation in September, 1940, as assistant superintendent of the foundry, core, and pattern departments at the Commonwealth plant at Granite City. He was appointed superintendent in October, 1944, and assistant

L. A. Kleber

works manager of the Commonwealth plant in October, 1947. Before joining General Steel Mr. Kleber had been with the Taylor-Wharton Iron & Steel Co.

◆

AMERICAN BRAKE SHOE COMPANY.—*Kempton Dunn* has been elected vice-president of the American Brake Shoe.

Mr. Dunn has been associated with Brake Shoe since he graduated from

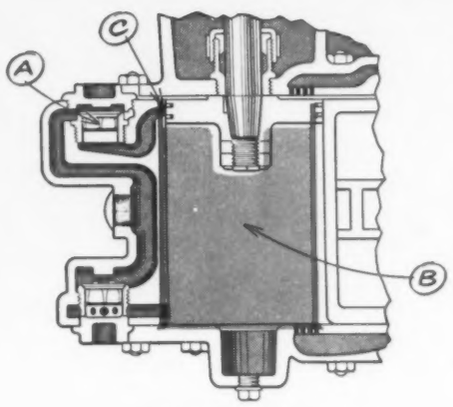
Kempton Dunn

college in 1932. He was elected treasurer of the company in 1942 and assumed the additional duties of secretary in 1947. In his capacity as vice-president, he will also continue as treasurer.

◆

TIMKEN ROLLER BEARING COMPANY.—*M. S. Downes,* assistant general sales manager of the railway division of the Timken Roller Bearing Company for the past 20 years, has been appointed general sales manager of the division to succeed W. C. Sanders, deceased. *J. E. McCort,* formerly district manager of the railway sales division in Cleveland, Ohio, has been appointed assistant general sales manager of the railway division to succeed Mr. Downes. *Ralph G. Harmon,* formerly a sales engineer in the Chicago office, has been appointed district manager of the industrial and steel

Case 1156—Eliminating Carbon Trouble in Locomotive Air Pumps



LOCOMOTIVE AIR PUMP
HIGH-PRESSURE CYLINDER AND DISCHARGE

After a full year of operation on an engine in main line service, the air discharge valves in the air pump, lubricated with Calol Air Pump Lubricant, were free of carbonaceous deposits ... pistons, rings and lands were also clean. Recommended for both the air and steam ends of Westinghouse and New York locomotive air compressors.

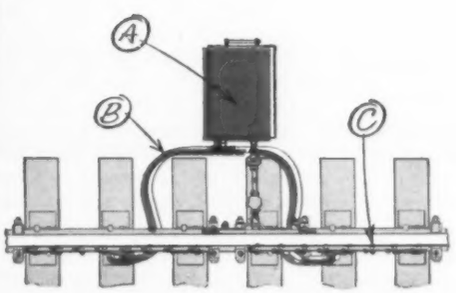
A. Contains special additive—resists oxidation and the formation of lacquer and carbon throughout the pump and especially in critical valves.

B. Prevents development of high temperatures . . . sticks on cylinder walls, pistons and other parts —minimizes oil carry over into air passages and valves.

C. Detergent keeps rings clean and free, air passages open.

Calol Air Pump Lubricant is made of selected stocks with very low carbon-forming tendencies.

Case 1141—Reducing Wear on Rails at Curves



AUTOMATIC RAIL AND FLANGE LUBRICATOR

Car and engine wheels carried Calol Rail and Flange Lubricant and lubricated rails for a distance of more than two miles from an automatic lubricator. Calol Rail and Flange Lubricant is made from a highly water-resistant base and special lubricating graphite.

A. Very stable in use and storage — will not separate in any climate along U.S. railroads . . . will not wash off rails or flanges.

B. Pumps freely from lubricator — suitable for use in temperatures from below zero F. to over 160 degrees above.

C. Forms and retains "button" formation on wiping bar.

Calol Rail and Flange Lubricant has a "short" non-stringy texture. This keeps it on flanges and the sides of rails and minimizes the usual tendency of grease to pull over the tops of rails.

For additional information and the name of your nearest Distributor, write

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street, San Francisco 20, California

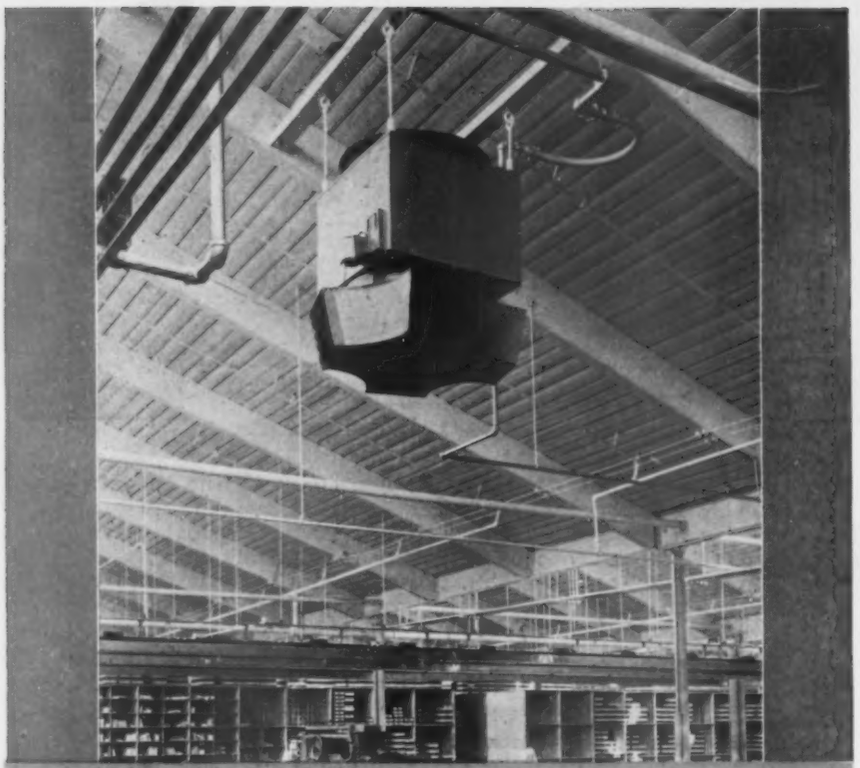
The California Oil Company
Barber, New Jersey

The California Company
17th and Stout Streets, Denver 1, Colo.

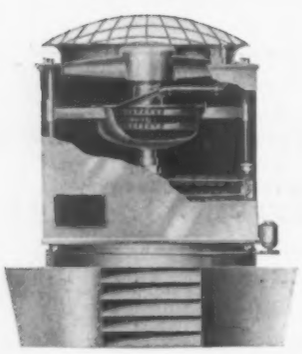
Standard Oil Company of Texas
El Paso, Texas

CALOL

Trademark Reg.
U.S. Pat. Office



Wing Turbine Driven Heater uses exhaust from fan turbine for heating



Where live steam of any pressure is available, it is possible to heat a plant advantageously by installing Wing Turbine Revolving Unit Heaters. The fan is driven by a Wing Turbine and the turbine exhaust is piped into the heater section. Electric motor and electric power are eliminated as the source of power (steam) is also the source of heat. The revolving discharge outlet distributes the heat to the working level, flowing around obstructions and to remote corners. Workers are pleased with the sensation of fresh, live, invigorating warmth. Write for descriptive bulletin or specific details.

L. J. Wing Mfg. Co. 52 Seventh Avenue, New York 11, N. Y.
Factories: Newark, N. J., and Montreal, Canada

Wing

Revolving UNIT HEATERS

tube divisions in Birmingham, Ala.

The Railway Division office of Timken in New York has been moved to 165 Broadway, New York 6. V. F. Murray, district manager, continues in charge of this Railway Division.

◆

OAKITE PRODUCTS, INC.—*Orlin H. Clark* has been appointed a representative of Oakite Products, Inc., Railway Service Division in the St. Louis, Mo., area.

Mr. Clark, prior to his Oakite appointment, was superintendent of the car department of the Missouri Pacific Lines

Orlin H. Clark

at St. Louis. He began his career in the car shops of the Louisville & Nashville in 1918 at Louisville, Ky. His association with the Missouri began in 1924. As a representative of Oakite, Mr. Clark will work out of St. Louis, serving railroads in the Central and Midwestern states.

◆

J. BARRAJA-FRAUENFELDER, formerly consulting engineer of the American Locomotive Company, has opened an office at 55 West Forty-Second street, New York 18, for consultations and project developments covering the internal combustion field in all its phases, particularly including the supercharging of two-cycle engines, free-piston compressors and gas generators for compounding with gas turbines, for land, marine and transportation applications, including naval power plants.

◆

KENNAMETAL, INC.—Kennametal, Inc., Latrobe, Pa., has been moved to 11 West Forty-Second street. *L. D. Morton*, acting manager, is assisted by *Gerald O. Bogner, John A. Storrs* and *J. G. Brady. C. Russell Miller* has been appointed a service engineer working out of the Cincinnati, Ohio, office; *Henry B. Worthington*, a sales engineer working out of the Springfield, Mass., office; and *Thomas J. Kniff, Jr.*, an application engineer working out of the Philadelphia, Pa., office.

◆

CHICAGO STEEL SERVICE COMPANY.—*Warren S. Marshall*, who has been associated with the Chicago Steel Service Company since 1937, has been appointed manager of railroad sales.

Mr. Marshall was born in Buffalo, N. Y. He completed his schooling at

STRIPPING TWO CAR WHEELS SIMULTANEOUSLY AT N.Y.O. & W.R.R. SHOPS, MIDDLETOWN, N. Y.

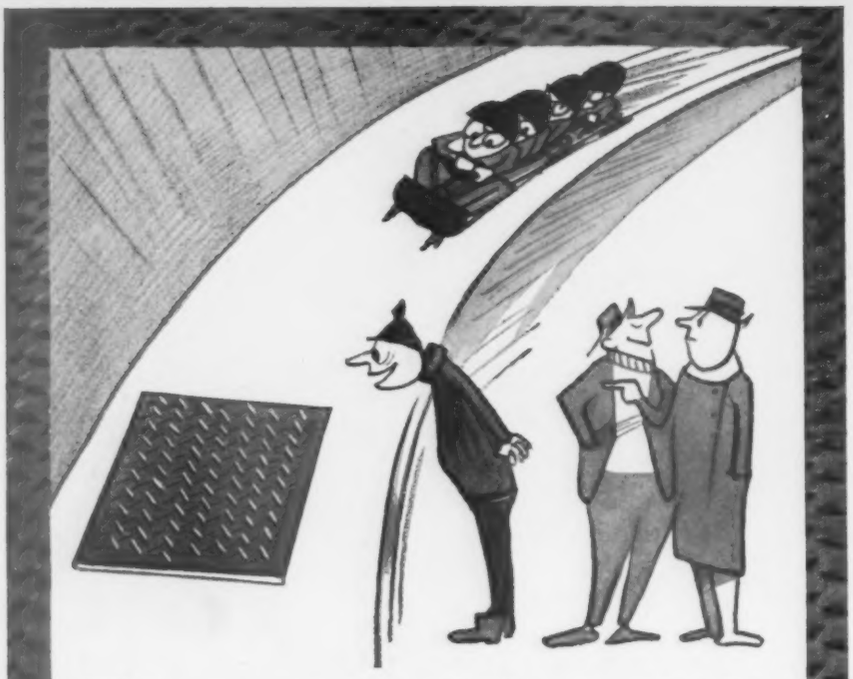
The Chambersburg Duplex Car Wheel Press strips both wheels of standard pairs simultaneously. The floor-to-floor time—frequently clocked at 42 seconds and averaging less than a minute—is unequalled by any other method.

PLACING GEAR PROTECTOR PREPARATORY TO STRIPPING DIESEL WHEEL

Details in Bulletin 18-L-8

CHAMBERSBURG ENGINEERING CO.

CHAMBERSBURG, PA.



"Johnson wants to see the fun when they hit that slip-resistant 4-WAY Safety Plate."

Feet and wheels, too, find positive traction on Inland 4-WAY Safety Plate. That's why 4-WAY cuts accidents. Its raised lug pattern—on floors, steps, ramps—grips firmly in all directions, reduces lost man hours due to slips and falls. INLAND STEEL CO., 38 South Dearborn St., Chicago 3, Ill.

WRITE FOR BOOKLET

Inland 4-WAY SAFETY PLATE

STOCKED BY LEADING STEEL WAREHOUSES

Reg. U. S. Pat. Off.

Warren S. Marshall

Buffalo Technical School and, following service in the Navy during World War I, joined the engineering department of the Lackawanna Steel Company. He later served for 16 years with Joseph T. Ryerson & Son, Inc., first at Buffalo and later at Chicago. He joined Chicago Steel Service in 1937 as sales engineer.

◆

COMBUSTION ENGINEERING-SUPERHEATER, INC.—*Charles Ringel*, formerly mechanical engineer of the American Arch Company, has become associated with Combustion Engineering-Superheater, Inc.

◆

FAIRBANKS, MORSE & CO.—*L. F. Munson*, sales representative in the railroad department of Fairbanks, Morse & Co., since 1940, has been appointed locomo-

L. F. Munson

tive sales representative, with headquarters at St. Paul, Minn. Mr. Munson has been associated with Fairbanks-Morse since 1928, when he started as a scale erector at St. Paul.

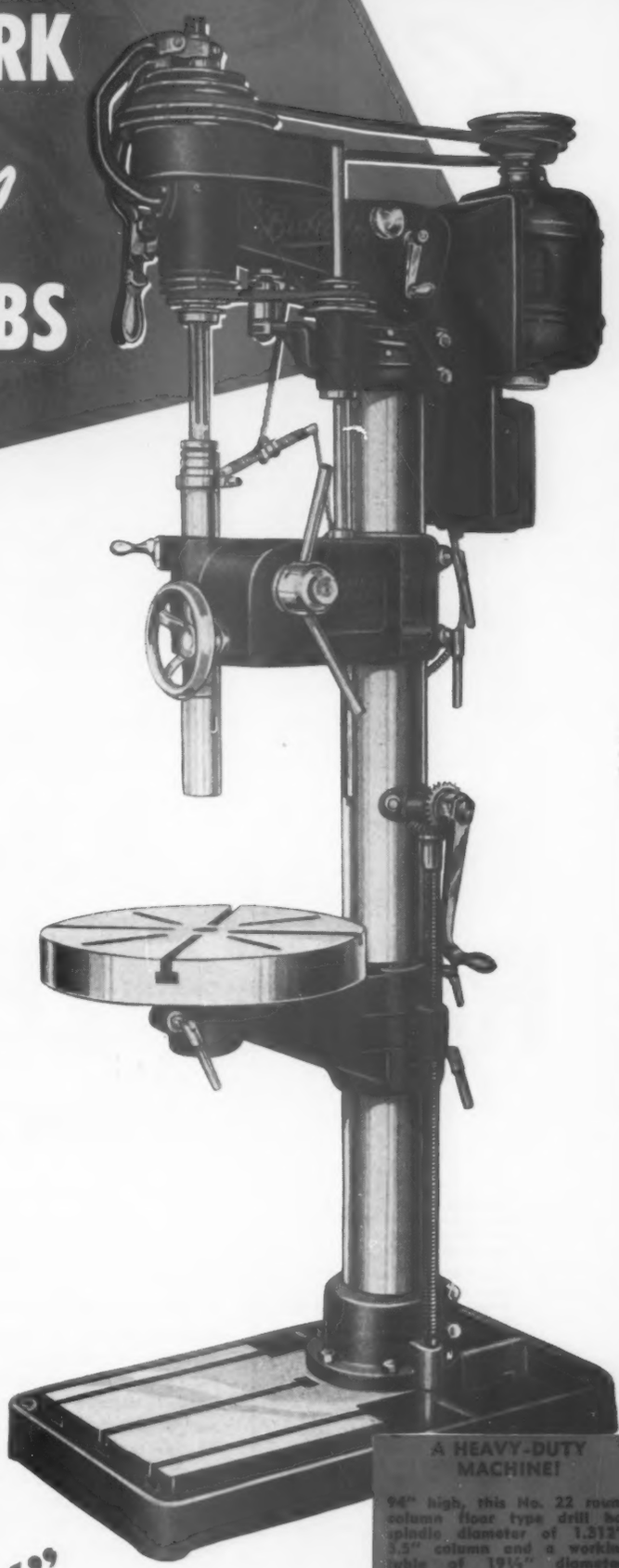
◆

BALDWIN LOCOMOTIVE WORKS.—*R. B. Crean*, who has been associated with the Baldwin Locomotive Works since 1943, has been appointed manager of a newly created Diesel renewal parts department. The department will include sales and warehousing of all Diesel renewal parts.

◆

AMERICAN ARCH COMPANY.—*C. W. Floyd Coffin* has been elected vice chairman of the board of the American Arch

MAKES SHORT WORK of Heavy Drilling in MAINTENANCE JOBS



"Buffalo" No. 22 DRILL

THIS heavy-duty machine drills up to 2" in cast iron and 1¼" in steel WITH ALL THE EASE OF SMALLER SENSITIVE DRILLS!

Controls are easy to reach and operate. No wrench adjustments are required for setup changes. Spindle feed stops and other parts are readily adjusted. Eight speeds give range of 65 to 1350 r.p.m. (with 1200 r.p.m. motor) for use with drills from 3/16" to 2", also for tapping and spot facing. The quick shift from direct to back gearing, too, is handy for reaming and tapping.

Speed up the many drilling operations in your maintenance jobs with the "Buffalo" No. 22, and you cut maintenance costs!

DRILLING FACTS!

Write for your free copy of Bulletin 2989-F and see the many convenience features built into the No. 22 — features that add up to years and years of lower cost drilling!

A HEAVY-DUTY MACHINE!

94" high, this No. 22 round column floor type drill has spindle diameter of 1.312", 3.5" column and a working table of 19½" diameter. Maximum distance, spindle nose to table is 27½". For the many heavy-duty features of the 22, write for Bulletin 2989-F.

"Buffalo" MACHINE TOOLS

BUFFALO FORGE COMPANY

174 MORTIMER STREET BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

DRILLING PUNCHING SHEARING CUTTING BENDING

Safeguard

Rolling Stock, Bridges, Tanks, Towers Metal Buildings, Signal Equipment and Other Properties Against COSTLY RUST!

Nothing equals Rust-Oleum —*the proved rust preventive* —for the lasting protection of metal—especially in closed or inaccessible areas where condensation due to temperature changes breeds rust.

RUST-OLEUM

Stops Rust!

- Rust-Oleum cuts preparation time. No sandblasting or chemical cleaners are necessary.
- Rust-Oleum outlasts ordinary materials two to ten times depending on conditions.
- Easy to use — Rust-Oleum assures lasting protection that resists rust-producing conditions.
- Apply by brush, dip or spray . . . in less time. Also available in small container sizes for economical distribution and field use.

Day and night—twenty-four hours a day—rust attacks railroad properties. Stop its deadly ravages by providing Rust-Oleum protection. Rust-Oleum coats metal with a tough, pliable moistureproof film that lasts years longer. *It's the proved answer to many rust problems.*

Rust-Oleum can be applied effectively and economically on all metal surfaces now in service—even where rust has already started. Merely wire-brush to remove scale and loose rust. Rust-Oleum merges the remaining rust into a rust-resisting, durable coating that defies time and the elements.

Save time and labor. Avoid frequent and costly replacements. Protect your properties with Rust-Oleum. Specify Rust-Oleum on new equipment, for re-building jobs . . . and for maintenance.

Get the facts now! Write for catalog containing complete information and recommended applications. Tell us your specific rust problems and we will gladly send you definite suggestions for Rust-Oleum applications.

RUST-OLEUM Corporation

2419 Oakton Street Evanston, Illinois

Company, suceeding *B. A. Clements*, who has retired. New directors of the company include *Frederick A. Schaff*, chairman of the board of Combustion Engineering-Superheater, Inc.; *Arthur F. Becker*, vice-president, American Arch Company, and *Roger L. Wensley*, president of the G. M. Basford Company.

◆

UNION ASBESTOS & RUBBER CO.—*J. B. Crawford*, formerly plant manager at the Cicero, Ill., plant of the Union Asbestos & Rubber Co., has been appointed manager of the company's new plant at McGregor, Tex.

◆

CHERRY RIVET COMPANY.—*J. E. Nelson*, division sales manager in national sales for the Cherry Rivet Company, has been appointed general sales manager. Before he joined Cherry Rivet in 1948, Mr. Nelson was with Manning, Maxwell & Moore.

◆

UNITED STATES STEEL SUPPLY COMPANY.—*Eugene G. Sheasby*, manager of the market development division, United States Steel Supply Company (subsidiary of United States Steel Corporation), at Chicago, has been appointed general staff manager, general sales division. *Russell J. Skinner*, office manager at St. Louis, Mo., has been appointed assistant district manager at St. Louis.

◆

INTERNATIONAL NICKEL COMPANY.—*John F. Thompson*, executive vice-president of the International Nickel Company since 1936, has been elected president, to succeed *Robert C. Stanley*, who continues as chairman of the board. *Paul D. Merica*, vice-president since 1936, has become executive vice-president. *Henry S. Wingate*, secretary since 1939, has become also a vice-president.

◆

G-V CONTROLS, INC.—G-V Controls, Inc., 28 Hollywood plaza, East Orange, N. J., has been organized to engage in development and manufacture of electrical control equipment. *C. D. Geer*, formerly vice-president of Thomas A. Edison, Inc. West Orange, N. J., is president of the new company.

OBITUARY

HARRY WOODWARD BEEDLE, who retired in June, 1948, as manager of the Boston, Mass., branch of the Electric Storage Battery Company, died on February 3. He was 69 years old.

◆

THOMAS W. DELANTY, president of the Chicago Steel Structures Company and vice-president of the Apex Railway Products Company, died on February 26. Mr. Delanty was 57 years old.

◆

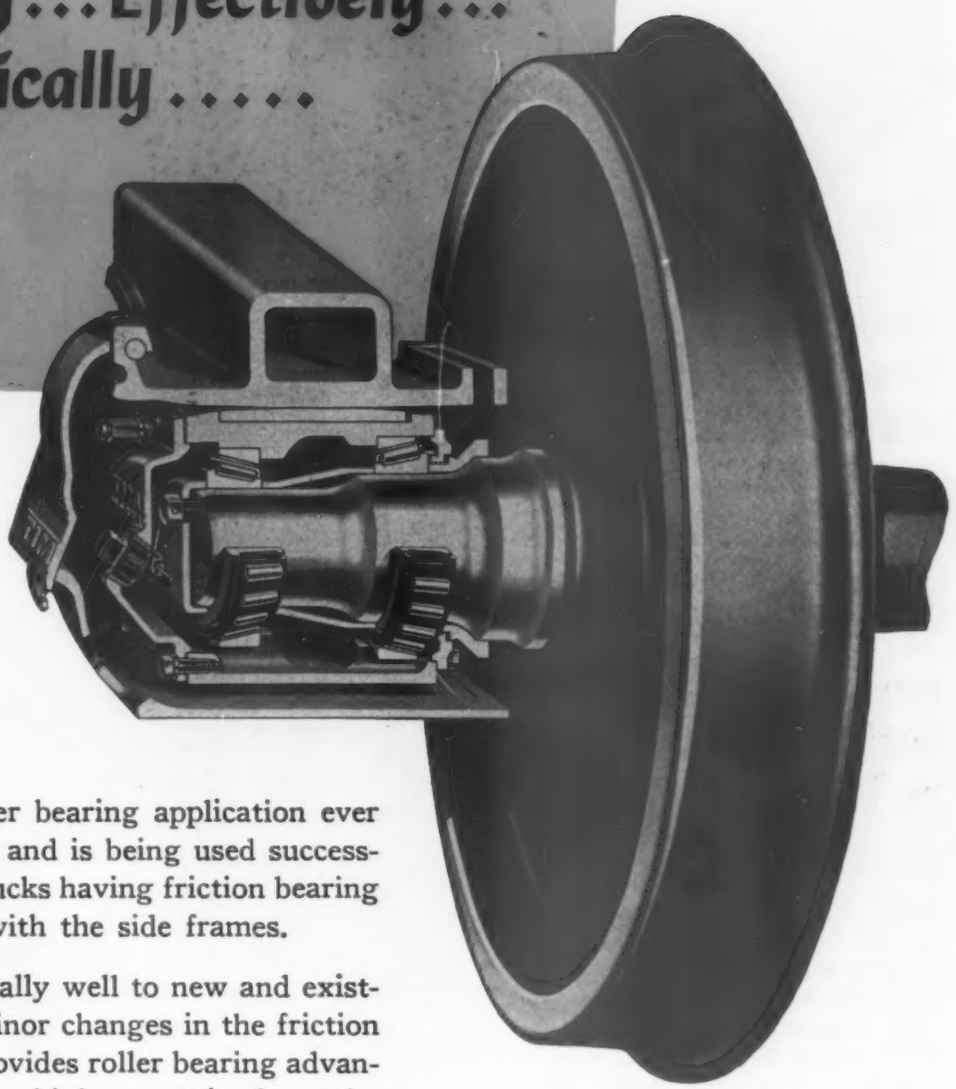
JOHN A. LECAIN, designer of the later types of Worthington locomotive feedwater heater equipment and inventor and patentee of the LeCain steam valve gear, died suddenly on February 11. Mr. LeCain had been with the Worthington Pump & Machinery Corp. over 41 years.

◆

CHARLES P. LOVELL, who had been associated with the New York Air Brake Company and its predecessor, the Eames Vacuum Brake Company, since June,

MAKES STANDARD FREIGHT CARS
ROLLER FREIGHT CARS

Quickly... Effectively... Economically.....



This is the only roller bearing application ever designed that can be and is being used successfully in freight car trucks having friction bearing boxes cast integral with the side frames.

It can be applied equally well to new and existing cars with only minor changes in the friction bearing boxes and provides roller bearing advantages in full, including higher sustained speeds; 88% less starting resistance; elimination of hot box delays; no reduction in winter tonnage; increased availability for service.

Moderate initial cost per car. Low operating and maintenance expense. Write for specific information covering your own requirements.

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CANTON 6, OHIO · CABLE ADDRESS "TIMROSCO"

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TRADE-MARK REG. U. S. PAT. OFF.
RAILWAY ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ⬯ AND THRUST —⬯— LOADS OR ANY COMBINATION —✳—

here is more than PACKAGED MOTIVE POWER... here is the POWER to *KEEP MOVING!*

KW

Industrial trucks and tractors are not "show horses," on the stage for a brief moment... they are *work* horses, demanding continuous, *constant,* dependable power. That's why K. W. *welcomes* the buyer who keeps a record of battery life, maintenance cost and dependABILITY to *KEEP* MOVING!

K. W. BATTERY COMPANY, Inc.

3705 N. LINCOLN AVE. CHICAGO 13

Foot of MONTAGUE ST. BROOKLYN 2

1887, died on February 28. Mr. Lovell, who was born in Lincolnshire, England, on December 8, 1864, came to the United States in 1871. He began his career at the age of 14 as an apprentice on the Chicago, Rock Island & Pacific and joined the New York Air Brake Company as a service engineer.

Personal Mention

General

GEORGE A. HOWARD, who has been appointed mechanical engineer, shop methods, of the Canadian National at Montreal, Que., as noted in the March issue, was born at Glossop, England. He began his railway service in 1920 as an apprentice at Winnipeg, Man., with the Canadian National. He was appointed mechanic in

George A. Howard

1926, an apprentice instructor in 1931; regional apprentice supervisor at Winnipeg in 1939; supervisor of accident prevention in 1943; general supervisor of apprentice training in 1945; shop foreman at the Point St. Charles shops in 1947, and general inspector of shop methods at Montreal in 1948.

J. L. REED, master mechanic of the Chicago & North Western at Sioux City, Iowa, has been appointed superintendent of motive power and machinery, with jurisdiction over the Eastern and Western districts, and headquarters at St. Paul, Minn. The position of master mechanic at Sioux City has been discontinued.

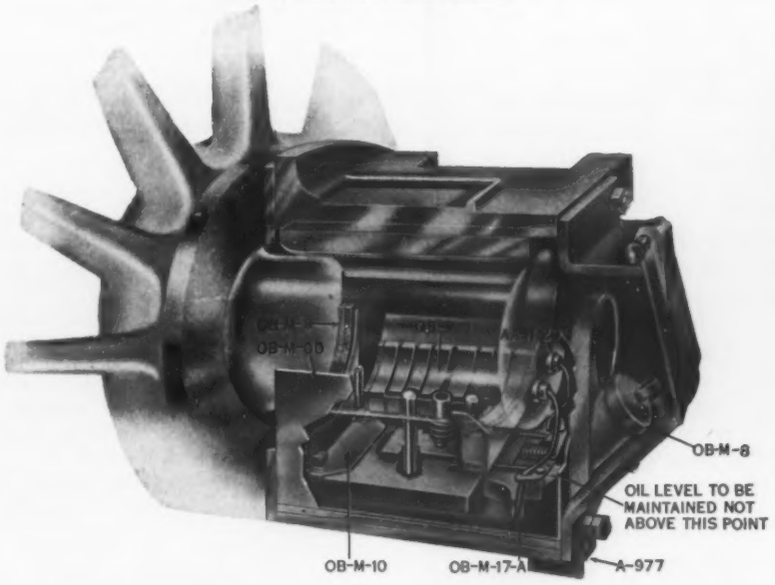
H. W. PROCTOR, master mechanic of the Chicago & North Western, at St. Paul, Minn., has been promoted to superintendent of motive power and machinery at St. Paul.

A. G. GREENSETH, whose appointment as general mechanical superintendent of the Minneapolis, St. Paul & Sault Ste. Marie at Minneapolis, Minn., was announced in the February issue, entered railroad service in 1903 as an apprentice machinist for the Great Northern at Superior, Wis. He later served successively as

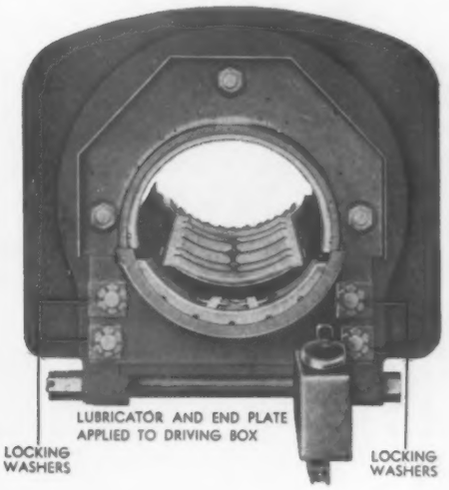
HENNESSY MECHANICAL JOURNAL LUBRICATOR

For All Journals of Railway Equipment—Lead Truck, Trailer, Driving, A.A.R. Journals, including Tender and Car Journals

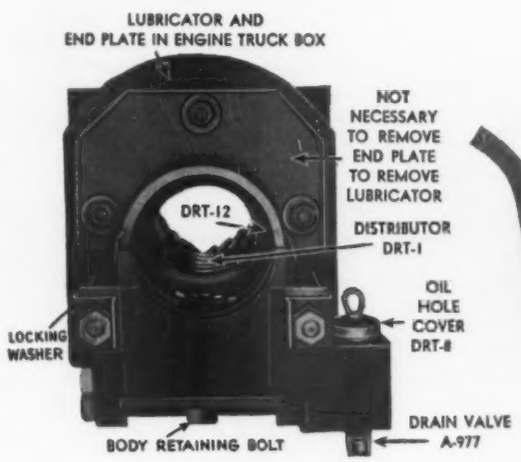
Type OBM Lubricator for Outside Bearing Locomotive Trailer Journals



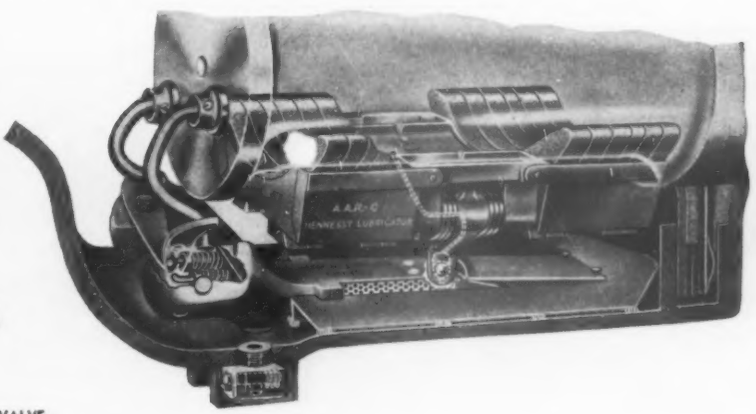
Type DR-S Lubricator for Driving Journals



Type DR-T Lubricator for Lead Truck and Inside Bearing Trailer Journals


LUBRICATOR AND END PLATE IN ENGINE TRUCK BOX
NOT NECESSARY TO REMOVE END PLATE TO REMOVE LUBRICATOR
DRT-12
DISTRIBUTOR DRT-1
OIL HOLE COVER DRT-8
LOCKING WASHER
DRAIN VALVE A-977
BODY RETAINING BOLT

Type AAR-C Mechanical Journal Lubricator for A. A. R. Journals



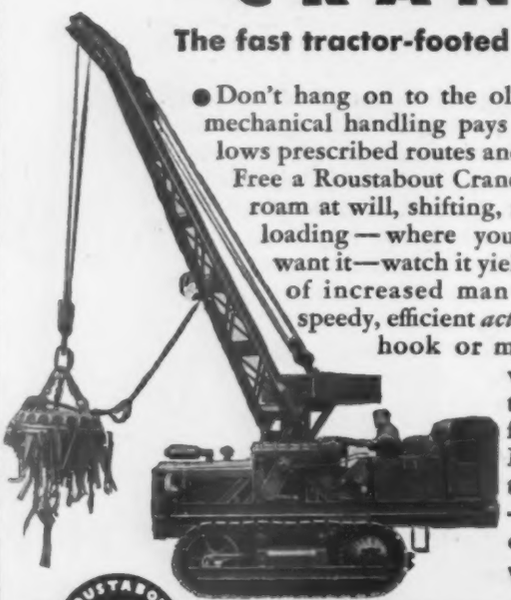
THE Hennessy Mechanical Journal Lubricator delivers oil of any consistency to the face of the journal by mechanical action when locomotive or car is in operation. No waste or other fibrous material is used. Individual pumps are used for each journal, which pumps are operated by the lateral movement of the wheels cross-wise of track. The lubricators are applicable to present equipment without change to journal boxes or journals, are simple in construction and do not require any special attention other than inspection at regular intervals. No adjustments are necessary.

Use of the Hennessy Mechanical Journal Lubricator reduces cost of lubricant, labor and material as well as effecting a very material increase in overall availability. Oil bath lubrication greatly increases the life of bearings, journals and hub faces. Hennessy lubricators have been in use on the heaviest locomotives in this country for the past 25 years.

HENNESSEY LUBRICATOR CO. INC., CHAMBERSBURG, PA.

Mechanical handling in your yard pays too—
with ROUSTABOUT CRANES

The fast tractor-footed load-hustlers



● Don't hang on to the old-fashioned idea that mechanical handling pays off only when it follows prescribed routes and methods — indoors. Free a Roustabout Crane in your yard — let it roam at will, shifting, stacking, loading, unloading — where you want it, when you want it—watch it yield pay dirt in the form of increased man hour savings—and speedy, efficient *action*. Loads to 7½ tons, hook or magnet, mounted on wheel or crawler tractors. Ruggedly built for years of overwork. Make your yard contribute to profits, too — get the Roustabout economy facts now.

Write to Dept. G-2.

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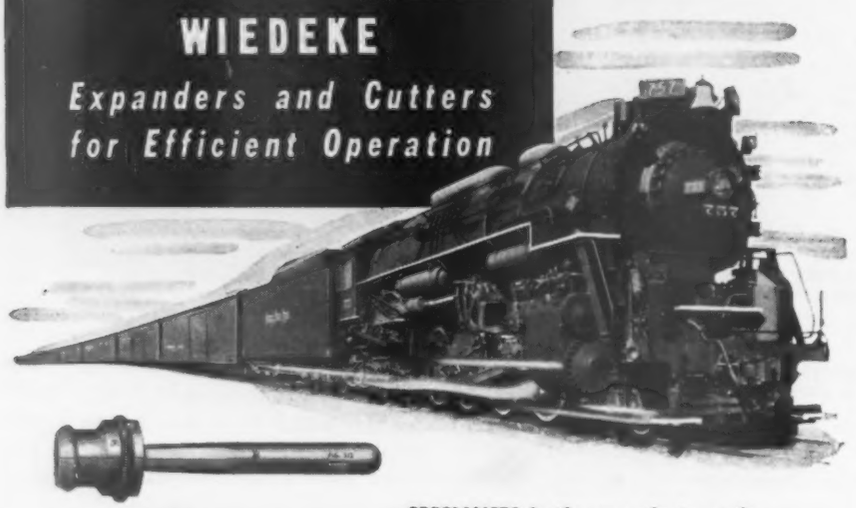
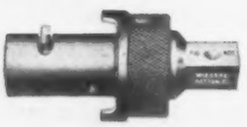
HUGHES-KEENAN CORPORATION
DELAWARE, OHIO, U. S. A.
Load-Handling Specialists since 1904

WIEDEKE
Expanders and Cutters for Efficient Operation





***SPECIALISTS** in the manufacture of:*
Ideal Sectional Expanders, universally used to expand flue tubes in locomotive flue sheets. The accurately machined, interchangeable sections form a true circle when fully expanded.

Ideal Safety Power Cutters will cut flues off in one revolution, with a clean-square edge for safe ending.

Write for IDEAL CATALOG No. 57

The Gustav Wiedeke Company
DAYTON 1, OHIO

a machinist with the Chicago Great Western at Clarion, Iowa, with the Soo Line at Minneapolis, with the G. N. at Superior, and again with the Soo Line at Enderlin, N. D. In 1913 he became enginehouse foreman for the Soo Line at Bismarck, N. D., and subsequently was enginehouse foreman at Thief River Falls, Minn., until World War I, when he entered Russian military service. After the war he returned to the Soo Line at Thief River Falls. In 1923 he became enginehouse foreman at Minneapolis; in 1924, master mechanic at Enderlin; master mechanic at Fond du Lac, Wis., in 1927; assistant mechanical superintendent at Minneapolis in 1939, and mechanical superintendent in 1944.

RUSSELL GOULD, acting superintendent of motive power of the Sacramento Northern at Sacramento, Calif., has been appointed superintendent of motive power at Sacramento.

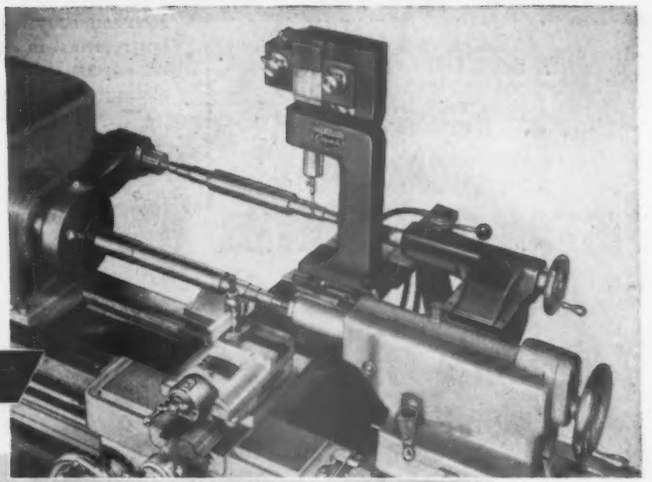
ERIC WYNNE, whose appointment as general superintendent of motive power and car equipment of the Atlantic region of the Canadian National at Moncton, N. B., was reported in the February issue, was born in Stafford, England. He joined the mechanical department of the Grand Trunk (Canadian National) at Melville, Sask., as a call boy, later becoming a machinist apprentice. In March, 1921, he became a machinist at Edmonton, Alta., and later served as machinist, acting foreman, Ledgerwood operator and locomotive foreman at McBride, B. C. He was subsequently transferred to the Fort Rouge shops at Winnipeg, Man. In June, 1936, he was appointed engine inspector in February, 1942, supervisor of special work; in January, 1943, mechanical inspector for the system, with headquarters at Montreal, and in August, 1943, mechanical engineer, shop methods.

C. F. GUGGISBERG, whose appointment as mechanical superintendent of the Minneapolis, St. Paul & Sault Ste. Marie at Minneapolis, Minn., was reported in the February issue, was born on June 16, 1895. He holds a B. S. degree in Mechanical Engineering. He entered railroad service in 1916 with the Duluth, Missabe & Northern at Proctor, Minn., and before and during World War I was a draftsman for the United States Navy Department at Portsmouth, N. H.; the Mobile Shipbuilding Company, Mobile, Ala.; the Todd Shipbuilding Company, Tacoma, Wash., and the Minneapolis Steel & Machinery Co. He returned to the Soo Line as a draftsman in 1920, and became chief draftsman in 1923. Mr. Guggisberg was appointed mechanical engineer in 1937 and assistant mechanical superintendent at Minneapolis in 1944.

Car Department

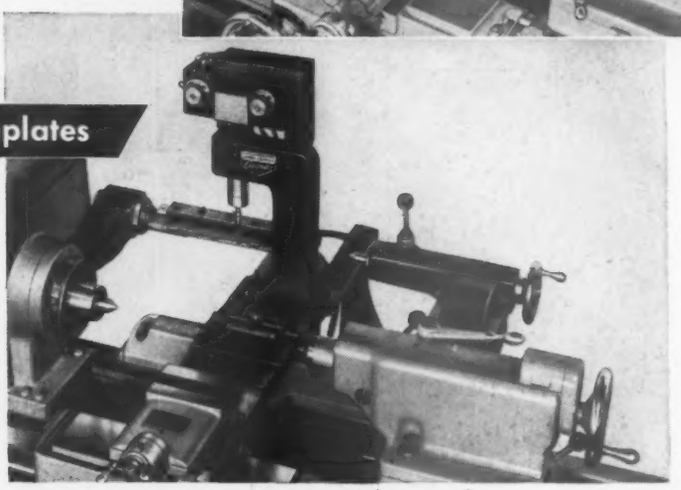
D. MACDONALD, whose appointment as superintendent of car equipment of the Atlantic region of the Canadian National at Moncton, N. B., was reported in the February issue, was born at Glasgow, Scotland, on March 4, 1886. Mr. Macdonald joined the Canadian National in October, 1904, as a plumber assistant in the

GET INSTANT CHANGEOVER...

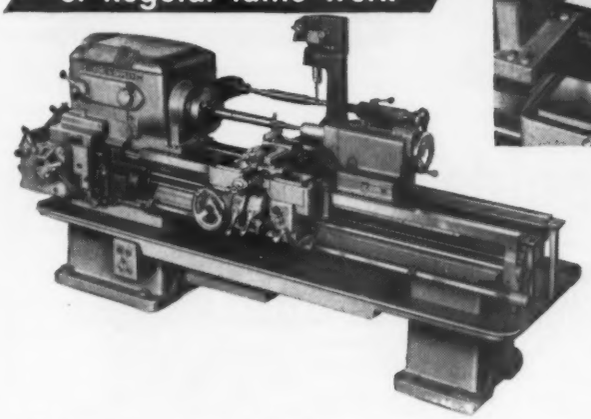


Duplicating from round templates

or Duplicating from flat templates



or Regular lathe work

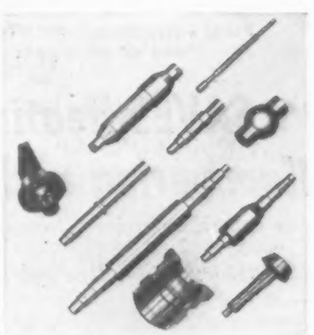


with the *NEW* Lodge & Shipley COPYMATIC!

IT TAKES JUST A MINUTE to change from regular lathe work to automatic tracer controlled duplication (or vice versa). There are no attachments to take off... no gadgets to put on.

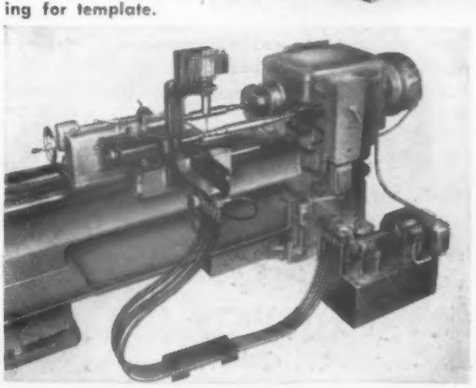
Using either flat or round templates, the COPYMATIC reproduces square shoulder faces, grinding necks, tapers in both directions, chamfers and curved contours with a high degree of accuracy. Often, the need for a special template is eliminated... the first piece of a lot may be produced by standard lathe operation, inserted in the holder and used to produce the rest of the lot automatically.

The COPYMATIC offers all the convenience and speed of hydraulic duplication, with all the versatility of the highly efficient Lodge & Shipley "Model X" Lathe. This double adaptability of the COPYMATIC takes it out of the special purpose machine classification, makes it a profitable producer for any size shop. Ask your Lodge & Shipley Representative for additional details or write for Bulletin #675.



• *Right:* A few samples of the wide variety of shapes produced by the COPYMATIC... both turning and boring operations are performed to very close limits.

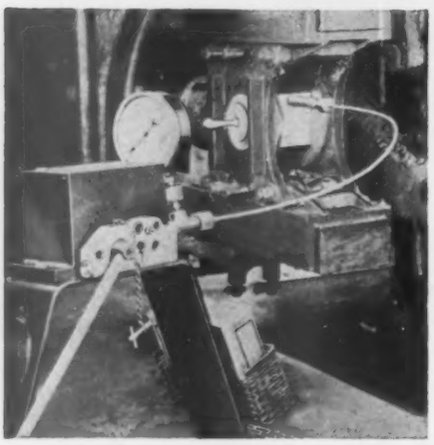
• *Below:* Rear view of COPYMATIC, showing hydraulic power unit and mounting for template.



THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

Keep Your SPERRY HYDRAULIC PISTON ROD PARTER Operating at Maximum Efficiency



All Parts Now Available

You'll find that overhauling and replacing worn parts on your Sperry Hydraulic Piston Rod Parter pays dollar-and-cents dividends in your round house. Check today, and order any of these parts you need direct from Sperry:

Pressure Valve	P-10
Pump Plunger Packing	P-5
By-Pass Valve Packing	P-16
Ram Cup Packing	T-4, L-4
Relief Valve Discs	T-14

and all other parts

SAVES Heating, Hammering and Time

- Separates piston rod from cross head quickly.
- Reduces labor. One man does the job.
- Exerts 150 to 250 tons of hydraulic pressure against end of rod.
- Easy to set up and operate—no wedges, no loose filler blocks.
- Prevents injuries to workers. Cannot damage piston rod.

For full information on the fast, economical Sperry Hydraulic Piston Rod Parter, write for Bulletin 5000. C-4

SPERRY

SPERRY PRODUCTS, INC.
DANBURY, CONN.

SP-145

Moncton shops. He left in April, 1906, but returned in April, 1907, as a machinist apprentice at Moncton. After completing his apprenticeship, he again left

D. Macdonald

railway service, but in August, 1912, returned to the C.N.R. as a draftsman. He became district car foreman at Moncton in June, 1923, and assistant superintendent car shops in November, 1924.

Master Mechanics and Road Foremen

HAROLD F. MACKEY, supervisor of Diesel engines of the Atchison, Topeka & Santa Fe at Chicago, has been appointed master mechanic, with headquarters at Clovis, N. M.

E. B. WOOD, general foreman in the locomotive department of the Atchison, Topeka & Santa Fe at San Bernardino, Calif., has been appointed master mechanic, with headquarters at Dodge City, Kan.

Shop and Enginehouse

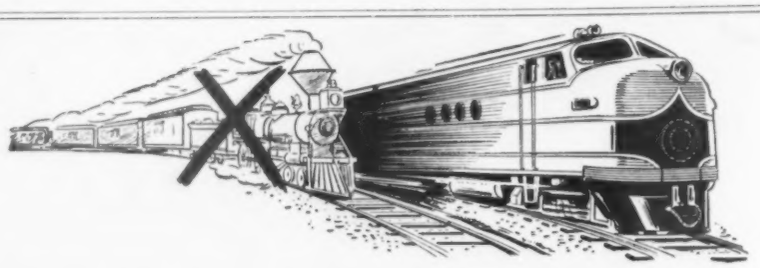
H. L. PRICE, master mechanic of the Atchison, Topeka & Santa Fe at Chicago, has been appointed superintendent of shops at Albuquerque, N. M.

G. R. MILLER, superintendent of shops of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., has retired.

G. C. KISTNER, master mechanic of the Atchison, Topeka & Santa Fe at Clovis, N. M., has been appointed assistant shop superintendent at Albuquerque, N. M.

Obituary

P. J. COLLIGAN, who retired in 1936 as general superintendent of motive power for the Chicago, Rock Island & Pacific at Kansas City, Mo., died recently at his home in Moline, Ill., after a brief illness.



In Transportation's March of Progress PERMAG Compounds have served successfully

PERMAG CLEANING COMPOUNDS began their service on railroads 25 years ago. Cleaning requirements were fewer then, but with the development of giant steam locomotives and the powerful streamlined Diesels of today cleaning work increased. More speed and greater efficiency were demanded. PERMAG met the new demands of this modern era of railroads, and is now used by leading roads and for general maintenance throughout the country.

PERMAG CAR CLEANER—for quick removal of Diesel oil film, dirt and grease from stainless steel and painted coaches.

Let us send you more details about PERMAG Compounds for railroads.

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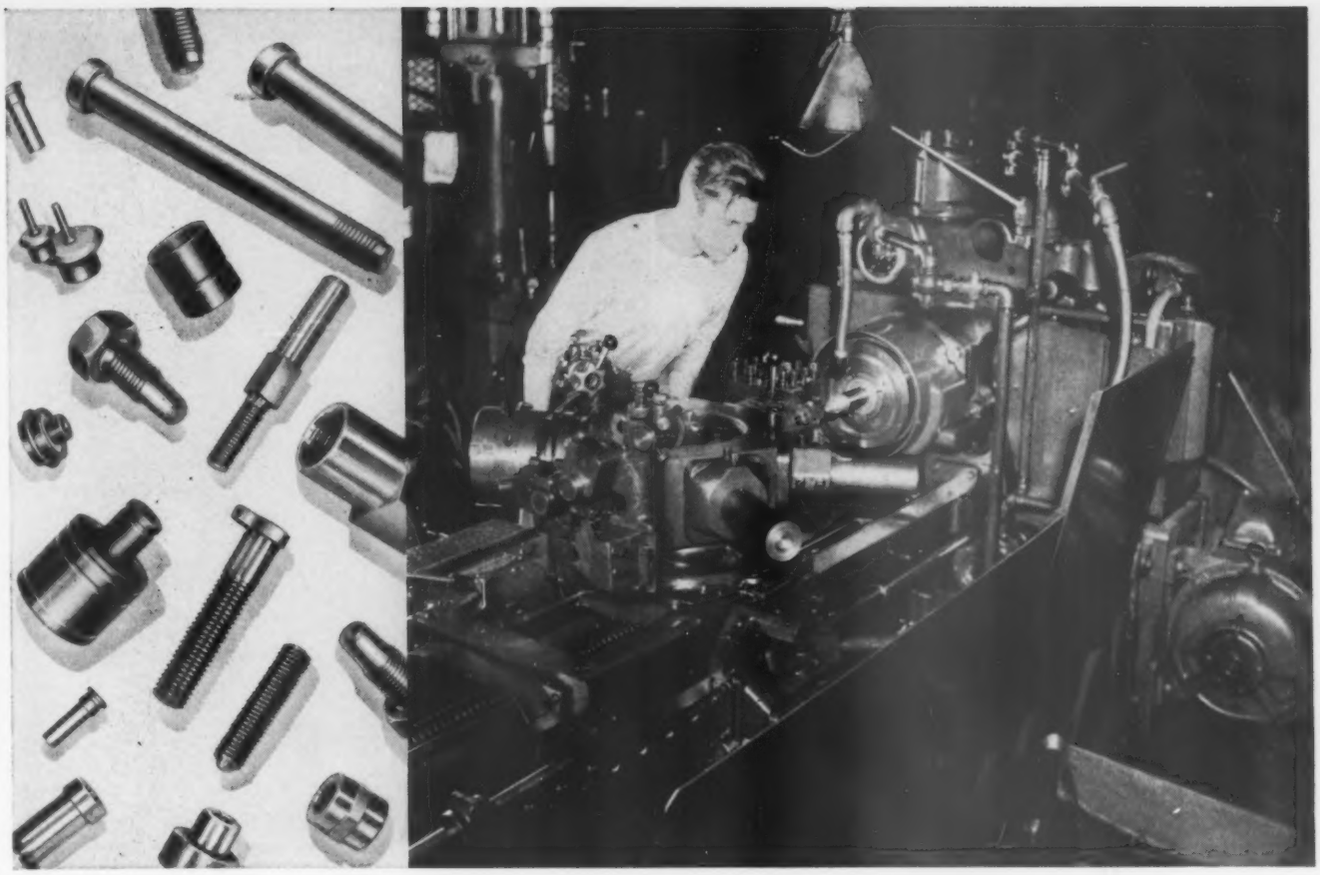
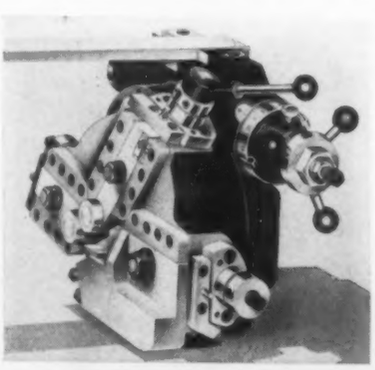
PERMAG Cleaning Compounds



All bolts and bushings for whole railroad system machined on a single WARNER & SWASEY

A WARNER & SWASEY 2-A in the Macon shops of the Central of Georgia Railroad provides an excellent example of the versatility and productiveness of a modern Warner & Swasey turret lathe.

This machine, using a universal tooling setup, does all the turning, forming, boring, drilling and threading for all of bolts and bushings needed as repair parts for the entire railroad. Switching from job to job takes little or no down time for tool changes. The rigidity, power, precision and quick adaptability of this Warner & Swasey really pay off in railroad shop service.



The Warner & Swasey Taper Turner is especially designed for turning frame bolts and other precise taper jobs with a single pass. Used in one tool station of the hex turret, it doesn't interfere with other tools set up for production jobs.

The new Tool Catalog illustrates 596 turret lathe tools and shows how they are used. Valuable data on universal tooling setups, spindle noses, cross slides and turret faces are also included. Write for your copy of "Turret Lathe Tools" today.

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TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

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Nothing equals Rust-Oleum —*the proved rust preventive* —for the lasting protection of metal—especially in closed or inaccessible areas where condensation due to temperature changes breeds rust.

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Stops Rust!

- Rust-Oleum cuts preparation time. No sandblasting or chemical cleaners are necessary.
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- Easy to use — Rust-Oleum assures lasting protection that resists rust-producing conditions.
- Apply by brush, dip or spray . . . in less time. Also available in small container sizes for economical distribution and field use.

Day and night—twenty-four hours a day—rust attacks railroad properties. Stop its deadly ravages by providing Rust-Oleum protection. Rust-Oleum coats metal with a tough, pliable moistureproof film that lasts years longer. *It's the proved answer to many rust problems.*

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RUST-OLEUM Corporation

2419 Oakton Street Evanston, Illinois

Company, suceeding *B. A. Clements*, who has retired. New directors of the company include *Frederick A. Schaff*, chairman of the board of Combustion Engineering-Superheater, Inc.; *Arthur F. Becker*, vice-president, American Arch Company, and *Roger L. Wensley*, president of the G. M. Basford Company.

◆

UNION ASBESTOS & RUBBER CO.—*J. B. Crawford*, formerly plant manager at the Cicero, Ill., plant of the Union Asbestos & Rubber Co., has been appointed manager of the company's new plant at McGregor, Tex.

◆

CHERRY RIVET COMPANY.—*J. E. Nelson*, division sales manager in national sales for the Cherry Rivet Company, has been appointed general sales manager. Before he joined Cherry Rivet in 1948, Mr. Nelson was with Manning, Maxwell & Moore.

◆

UNITED STATES STEEL SUPPLY COMPANY.—*Eugene G. Sheasby*, manager of the market development division, United States Steel Supply Company (subsidiary of United States Steel Corporation), at Chicago, has been appointed general staff manager, general sales division. *Russell J. Skinner*, office manager at St. Louis, Mo., has been appointed assistant district manager at St. Louis.

◆

INTERNATIONAL NICKEL COMPANY.—*John F. Thompson*, executive vice-president of the International Nickel Company since 1936, has been elected president, to succeed *Robert C. Stanley*, who continues as chairman of the board. *Paul D. Merica*, vice-president since 1936, has become executive vice-president. *Henry S. Wingate*, secretary since 1939, has become also a vice-president.

◆

G-V CONTROLS, INC.—G-V Controls, Inc., 28 Hollywood plaza, East Orange, N. J., has been organized to engage in development and manufacture of electrical control equipment. *C. D. Geer*, formerly vice-president of Thomas A. Edison, Inc., West Orange, N. J., is president of the new company.

OBITUARY

HARRY WOODWARD BEEDLE, who retired in June, 1948, as manager of the Boston, Mass., branch of the Electric Storage Battery Company, died on February 3. He was 69 years old.

◆

THOMAS W. DELANTY, president of the Chicago Steel Structures Company and vice-president of the Apex Railway Products Company, died on February 26. Mr. Delanty was 57 years old.

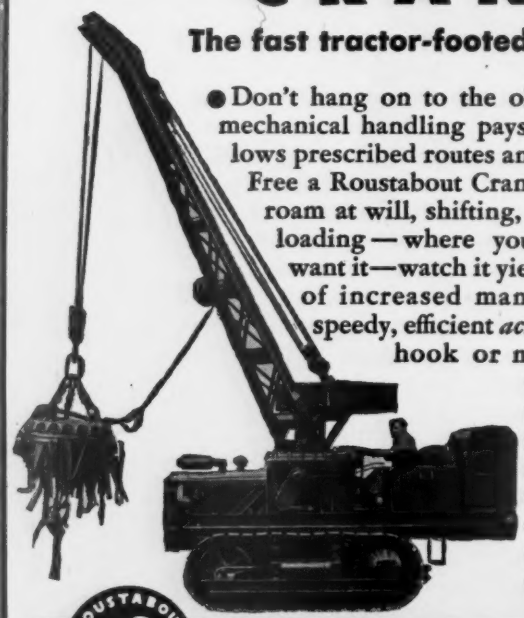
◆

JOHN A. LECAIN, designer of the later types of Worthington locomotive feedwater heater equipment and inventor and patentee of the LeCain steam valve gear, died suddenly on February 11. Mr. LeCain had been with the Worthington Pump & Machinery Corp. over 41 years.

◆

CHARLES P. LOVELL, who had been associated with the New York Air Brake Company and its predecessor, the Eames Vacuum Brake Company, since June,

Mechanical handling in your yard pays too—
with ROUSTABOUT CRANES
The fast tractor-footed load-hustlers



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Load-Handling Specialists since 1904

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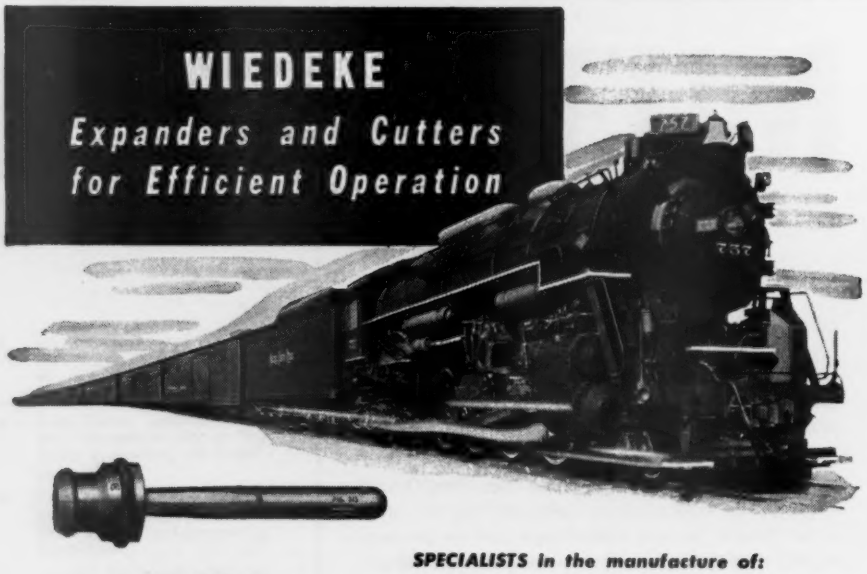

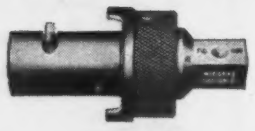

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Ideal Sectional Expanders, universally used to expand flue tubes in locomotive flue sheets. The accurately machined, interchangeable sections form a true circle when fully expanded.

Ideal Safety Power Cutters will cut flues off in one revolution, with a clean-square edge for safe ending.

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IDEAL CATALOG No. 57

The Gustav Wiedeke *Company*
DAYTON 1, OHIO

a machinist with the Chicago Great Western at Clarion, Iowa, with the Soo Line at Minneapolis, with the G. N. at Superior, and again with the Soo Line at Enderlin, N. D. In 1913 he became enginehouse foreman for the Soo Line at Bismarck, N. D., and subsequently was enginehouse foreman at Thief River Falls, Minn., until World War I, when he entered Russian military service. After the war he returned to the Soo Line at Thief River Falls. In 1923 he became enginehouse foreman at Minneapolis; in 1924, master mechanic at Enderlin; master mechanic at Fond du Lac, Wis., in 1927; assistant mechanical superintendent at Minneapolis in 1939, and mechanical superintendent in 1944.

RUSSELL GOULD, acting superintendent of motive power of the Sacramento Northern at Sacramento, Calif., has been appointed superintendent of motive power at Sacramento.

ERIC WYNNE, whose appointment as general superintendent of motive power and car equipment of the Atlantic region of the Canadian National at Moncton, N. B., was reported in the February issue, was born in Stafford, England. He joined the mechanical department of the Grand Trunk (Canadian National) at Melville, Sask., as a call boy, later becoming a machinist apprentice. In March, 1921, he became a machinist at Edmonton, Alta., and later served as machinist, acting foreman, Ledgerwood operator and locomotive foreman at McBride, B. C. He was subsequently transferred to the Fort Rouge shops at Winnipeg, Man. In June, 1936, he was appointed engine inspector in February, 1942, supervisor of special work; in January, 1943, mechanical inspector for the system, with headquarters at Montreal, and in August, 1943, mechanical engineer, shop methods.

C. F. GUGGISBERG, whose appointment as mechanical superintendent of the Minneapolis, St. Paul & Sault Ste. Marie at Minneapolis, Minn., was reported in the February issue, was born on June 16, 1895. He holds a B. S. degree in Mechanical Engineering. He entered railroad service in 1916 with the Duluth, Missabe & Northern at Proctor, Minn., and before and during World War I was a draftsman for the United States Navy Department at Portsmouth, N. H.; the Mobile Shipbuilding Company, Mobile, Ala.; the Todd Shipbuilding Company, Tacoma, Wash., and the Minneapolis Steel & Machinery Co. He returned to the Soo Line as a draftsman in 1920, and became chief draftsman in 1923. Mr. Guggisberg was appointed mechanical engineer in 1937 and assistant mechanical superintendent at Minneapolis in 1944.

Car Department

D. MACDONALD, whose appointment as superintendent of car equipment of the Atlantic region of the Canadian National at Moncton, N. B., was reported in the February issue, was born at Glasgow, Scotland, on March 4, 1886. Mr. Macdonald joined the Canadian National in October, 1904, as a plumber assistant in the